RESOURCE PRODUCTIVITY AND CAPITAL INVESTMENT IN THE FARM FIRM

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Master of Science

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by
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ABSTRACT

The major objective of this study was to show that without some knowledge of the productivity of the various resources and enterprises of the farm firm the efficient allocation of capital cannot be accomplished.

A record analysis and a budget or linear programming analysis based on an existing farm in south-central Manitoba were employed to show the necessity of efficient credit allocation.

The farmer on whose farm the study is based is a member of the Carman District Farm Business Association, therefore, farm records for the years 1957 to 1960 were available for the analysis.

The significant findings of the above investigation were as follows:

1. The marginal productivity of capital was considerably increased by the use of budget or linear programming analysis.
2. Linear programming analysis improved the enterprise combination on the farm under study, thus raising the farmer's net return.
3. Until operating capital reached a high level, marginal returns to this resource were shown to be considerably higher than marginal returns to the fixed resource land.

ACKNOWLEDGMENTS

The author is deeply indebted to the many people who assisted in the completion of this thesis. The counsel, constructive criticism and encouragement of Dr. J.C. Gilson is gratefully acknowledged. The general guidance and suggestions on style and form provided by Dr. S. Sinclair, Head of the Department of Agricultural Economics and Farm Management, is greatly appreciated.

Appreciation is expressed to the farmer and his wife on whose farm the study was based.

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CHAPTER I

INTRODUCTION

Agriculture in Canada today is a highly commercialized and competitive business. Present day farms require the investment of large amounts of capital in land, machinery and equipment. In 1951 capital investment in agriculture was $9,458 million and had risen to $13,171 million by 1961. This is approximately a 39 per cent increase in ten years. During the same period the labour force in agriculture decreased from 939 thousand people in 1951, to 674 thousand in 1961.

The expanding capital investment in agriculture has also led to a rapid reduction in the number of farms. The 1951 census reports 575,015 farms and by 1961 this figure was down to 480,903 farms. In Manitoba farm numbers for the same period dropped from 49,201 to 43,306. If acres alone were used as a measure of size then for Canada as a whole the average number of acres per farm declined slightly for the above ten year period. In the case of Manitoba, however, the number of acres in farm land showed an increase over the ten year period.[1] It is evident that capital investment per farm is increasing fairly rapidly. This is the result of new

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[1]Census of Canada, 1961. (Ottawa, Roger Duhamel, F.R.S.C. Queen's Printer).

technology which has caused drastic changes in farming methods. Farmers are forced to adopt continually new methods of production which require new and costly machines and buildings and other costly production techniques. The increase in farm size plus the new techniques create a need for large additional capital outlays by farmers.

A modern commercial family farm will require anywhere from $30,000 to $60,000 in capital investment. Yearly cash operating expenses may vary from $5000 to $20,000. The average capital investment in 1962 for the 86 farmers comprising the Carman District Farm Business Association of Manitoba was $60,647. Average operating expenses for the same group was $14,858 with another $6,435 for capital purchases making a total annual cash outlay of $21,293. The average debt for the farmers of the above group was $16,324.[2]

The increased need for farm credit has been recognized by both the Federal and Provincial governments. In recent years they have either set up new credit agencies or revised the existing ones. The Farm Credit Corporation, which was established in 1959 as the successor to the Canadian Farm Loan Board, loaned $68,887 thousand to 6,027 farmers in

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[2] J.P. Hudson, 1962 Annual Report of the Carman District Farm Business Association, (Department of Agricultural Economics and Farm Management, University of Manitoba, September, 1963).

1962.[3] In Manitoba, the Manitoba Agricultural Credit Corporation which was established in 1958, loaned $4,950 thousand to 428 farmers in 1962.[4] These are only two of the several lending agencies providing capital to farmers, mainly in the long term field.

Methods of improving farm credit analysis to determine the credit potential of a farm have been and are the concern of credit agencies, both government and private. Traditionally, the credit potential of a farm has been determined by an analysis of the assets or equity collateral of the borrower. Lending institutions have been concerned mainly with the safety of their loan and have been only indirectly concerned with the productivity of the additional capital.

Farmers must allocate scarce resources amongst competing enterprises in an attempt to maximize profit. How are they to do this without some knowledge of the productivity of the various enterprises that they have or could have in their farm business? Many farmers are adding additional capital to a particular farm enterprise that is actually losing money and is kept going only because it is being subsidized from the rest

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[3] Annual Report of the Farm Credit Corporation, 1962. (Ottawa, Roger Duhamel, F.R.S.C. Queen's Printer).

[4] Annual Report of the Manitoba Agricultural Credit Corporation, 1962. (Winnipeg, R.S. Evans, Queen's Printer).

of the farm business.

SCOPE AND OBJECTIVES

The basic hypotheses of this thesis are as follows:

(i) That budgetary analysis can be used as a means of improving agricultural credit analysis.

(ii) That a more efficient allocation of agricultural credit within the firm can be determined by the use of budget or productivity analysis.

Specific Objectives

1. To show that record analysis can (a) point up the weaknesses and strengths in the farm business, (b) help the farmer allocate his limited resources, and (c) help determine the credit potential of the farm.

2. The second objective, which is part of the major hypothesis, is to show that without productivity analysis neither the farmer nor the lending agency will know where the additional capital can be allocated most efficiently.

3. To show the effect of varying the "operating capital" resource. It is hypothesized that the quantity of this resource available will not only affect the income level but also determine the type of production plan which is most profitable.

There are further questions raised in this study which are not dealt with specifically. The question of "who" is

to receive additional capital is one of utmost importance, as is the need for a more integrated policy on all types of credit; long, intermediate and short term. These are subjects only discussed briefly and are topics for separate studies.

The scope of this study is implicit in the discussion of the objectives. The choice of only one existing farm as a base farm for this study was for the following reasons:

1. The use of an existing farm unit that is actually operating rather than a hypothetical farm precludes the possibility of situations arising that would not be found on an operating farm unit.

2. The farm chosen has a large capital investment in land and beef cattle but average labour earnings are not very large. This might indicate that some farm reorganization is necessary.

3. The farmer has been a member of the Carman District Farm Business Association since its inception in 1957, therefore good farm records are available for a number of years. These records are invaluable for credit analysis.

4. In 1960 the farmer obtained a loan from the Manitoba Agricultural Credit Corporation therefore his farm can be analysed both before and after the additional capital was added.

METHOD

This study involves the determination of the productivity of the firm under various conditions relating to resource use, especially capital. Linear programming is the main empirical tool used because it is a technique which allows the selection of optimum production plans and the best resource allocation

given assumptions about enterprises to be considered and resources available. The level of resources was not changed from that available on the farm as far as was practicable. The level of operating capital was varied in order to test the several hypotheses. Hay and corn selling activities were both included and excluded from the plans in order to force livestock into the plans.

CHAPTER II

THEORETICAL BACKGROUND

The firm has been defined as:

> A technical unit in which commodities are produced. Its entrepreneur (owner and manager) decides how much of and how one or more commodities will be produced and gains the profit or bears the loss which results from his decision. An entrepreneur transforms inputs into outputs, subject to the technical rules specified by his production function. The difference between his revenue from the sale of outputs and the sort of his inputs is his profit, if positive, or his loss, if negative.[1]

The word "decides" in the above statement is of utmost importance because the decisions of the entrepreneur can, to a large extent, mean the difference between profit or loss.

The farmer must combine his limited resources in such a way that his objective, which is predominately that of profit maximization, will be reached.

Additional capital is one of the resources that the farmer of today uses and will continue to use in increasing amounts. This thesis is concerned primarily with the considerations involved in the allocation of various quantities of capital within the farm firm when the goal is one of profit maximization.

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[1] Henderson, James M. and Quandt, Richard E., Microeconomic Theory, A Mathematical Approach. (New York, McGraw-Hill Book Company, Inc., 1958), Page 42.

Traditional credit appraisal methods have made little or no attempt to determine where the additional capital should be invested. For the purpose of this study any method of credit analysis that places the main emphasis on availability of ample security or collateral to cover the loan will be classed as a traditional method of appraisal.[2] While this is a necessary and important part of appraisal more thought should be given to the idea of looking at the farm firm as a whole unit and making credit available in order to increase the productivity of the whole farm unit.

For example, if a farmer attempted to borrow $10,000 to purchase either additional land or additional cattle the traditional method would appraise the farmer's assets, both land and cattle presently owned and to be purchased, and place a valuation on each. If this value was considered sufficient to cover the loan, that is, repay the lender if assets had to be sold, then it is likely that the farmer would receive the additional capital. However, neither the farmer nor the lender would know whether returns would be higher if the capital was invested in the cattle or the land or some combination of both; or indeed, whether the capital should be invested in some other aspect of the business.

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[2]For a detailed description of appraisal methods see, Murray, W.G., Farm Appraisal and Valuation. (Ames: Iowa State College Press), Fourth Edition.

With this method of analysis there is no way of knowing which enterprise would bring the higher returns. Even more critical is the fact that this method of analysis cannot really tell the farmer if it will pay him to borrow the money in the first place. The returns from either land or cattle may not be sufficient to pay the cost of the loan.

Another major limitation will immediately be evident from the above discussion. If increasing returns to scale are available the farmer might want to enlarge his business to make full use of his labor and machinery.[3] If he does not have sufficient equity collateral to secure the loan then he is not likely to receive it; he is forced to remain at an inefficient level even though the productivity of the additional capital investment may be quite high.

How does the traditional method of appraisal determine whether or not a farm firm needs additional capital? If efficiency of operation is achieved by a reorganization of the farm resources presently available there may be no need for additional capital. Adding land to the present farm may only enlarge the reorganization problem and raise income little if at all. The above question cannot be answered by the traditional method of appraisal.

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[3]Auer, Ludwig., "Productivity of Resources on Farms in the Newdale-Hamiota Area of Manitoba," (Unpublished Master's thesis, University of Manitoba, Winnipeg, 1959).

Farm Records

If adequate farm records are available, comparisons with other farms can be made and strengths and weaknesses discovered in the farm business. Comparisons of volume, efficiency, value of production and value of production per unit of invested capital can help the farmer make better decisions as well as show where further budgeting is necessary.

BUDGET OR PRODUCTIVITY ANALYSIS

If the farm firm is to realize the highest possible returns from the use of additional capital, it must be invested, having due regard for the risk and managerial ability of the farmer, in such a way that any further re-organization of the farm firm would not yield any increase in the income.

Profit maximization can only be achieved if the basic principles underlying production are applied to the firm. According to Murray and Nelson maximum returns can only be gained if the farmer considers:[4]

1. The proper enterprise combination.
2. Determinesthe most economical production practises.
3. Decides how large each of the enterprises should be.

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[4]Murray, W.A. and Nelson, Aaron, E., Agricultural Finance (Ames: Iowa State College Press) Fourth Edition, Page 85.

These are really the principles for the equilibrium of the firm stated in a different way. Hicks outlines clearly the three main production principles of (1) factor-factor, (2) product-product, (3) factor-product, as follows:[5]

> 1. Corresponding to the condition price = marginal cost, we have three sorts of conditions:
> a) The price - ratio between any two products must equal the marginal rate of substitution between the two products (this is now a technical rate of substitution).
> b) The price ratio between any two factors must equal their marginal rate of substitution.
> c) The price ratio between any factor and any product must equal the marginal rate of transformation between the factor and the product (that is to say, the marginal product of the factor in terms of this particular product).
>
> 2. Next there are the stability conditions. For the transformation of a factor into a product we shall have the condition ... of diminishing marginal rate of transformation or diminishing marginal product. For the substitution of the one product for another we shall have a condition of 'increasing marginal rate of substitution,' that is to say, increasing marginal cost in terms of the other product (marginal opportunity cost). For the substitution of one factor for another, 'diminishing marginal rate of substitution.'

Factor-Factor Principle

Capital, labour, land and the various other resources are combined in several alternative enterprises on the farm. Optimum allocation of the limited resources is obtained when

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[5]Hicks, J.R. Value and Capital. (Oxford, Clarendon Press), Second Edition, 1946. Pages 86-87.

the returns on a particular resource are equalized in all the various uses.

This principle is concerned with the substitution of one resource for another in the production of a given quantity of product. In most cases several resources are involved in the production process which can be represented by the following equation:

$$Y = f\ (X_1\ X_2\ X_3\ \ldots\ldots\ X_n)$$

where Y is the given amount of output and X_1 ..... X_n represent the various inputs. If all the inputs but two are held constant then the marginal rate of substitution for these two can be determined. For example, output of beef is a function of capital and labour, other inputs held constant. (The capital could be in the form of labour saving equipment).

Beef = f (capital, labour)

The equilibrium position (least-cost combination) is found by the following formula:

$$\frac{dL}{dC} = \frac{P_C}{P_L}$$

where $\frac{dL}{dC}$ is the marginal rate of substitution of capital for labour, P_L the price of labour and P_C the price of capital. This can be expressed as the ratio of the marginal value product of capital with the marginal value product labour as follows:

$$\frac{M.V.P._{cap.\ (beef)}}{P._{cap.}} = \frac{M.V.P._{lab.\ (beef)}}{P._{lab}}$$

where $M.V.P._{cap.}$ is the marginal value productivity of the resource capital in producing beef and $P._{cap.}$ is the price of capital and similarly for labour.

The factor-factor principle can be illustrated graphically using discontinuous iso-quants which are implicit in linear programming but still satisfy the marginal conditions for the equilibrium of the firm. To do this the concept of a line vector or process ray must first be introduced. Output of beef, in the above example, can be increased by increasing proportionately the amounts of capital and labour, output also increasing proportionately. In Figure 1, this relationship is shown by a straight line such as line 1. This line is called a line vector or a process ray.

In the production of beef the resources capital and labour can be combined in several different proportions to produce a unit of output. Each of these processes can be represented by a process ray, four of which are illustrated in Figure 1. There is a point on each of these rays where identical quantities of beef are produced. These points are connected to form the iso-product curve I_1; similarly for iso-product curve I_2. The price line is represented by

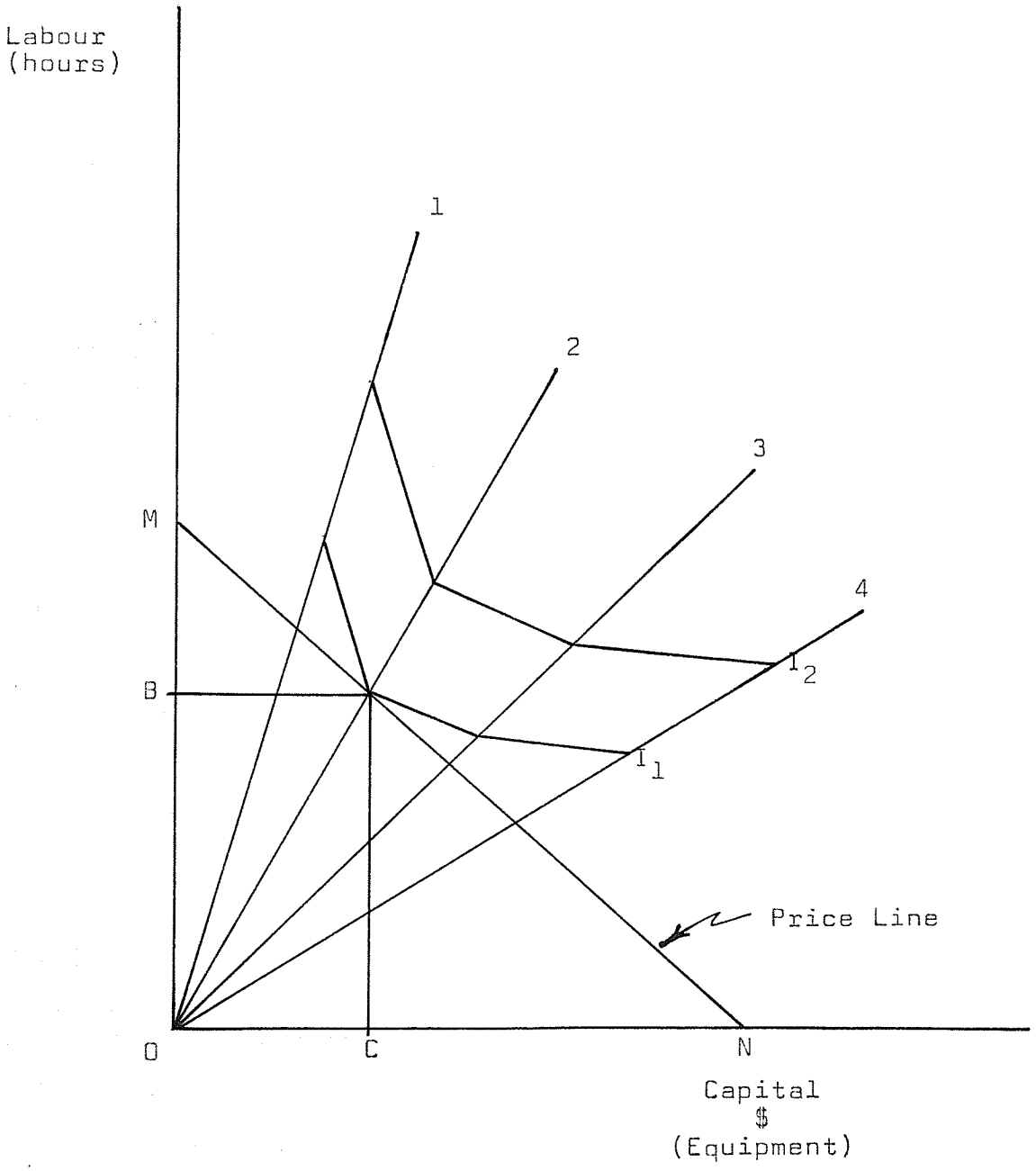

FIGURE 1

Factor-Factor Relationship
(discontinuous iso-quants)

MN in Figure 1. With this given price line the optimum combination of capital and labour is found where OC of capital and OB of labour are used. As can be seen from the diagram the price line can be rotated considerably before the optimum position changes.

In most cases farmers use several resources in various alternative enterprises on the farm. If capital is unlimited the equation for optimum allocation is as follows:

$$\frac{M.V.P._{x_1 y_1}}{P._{x_1}} = \frac{M.V.P._{x_2 y_2}}{P._{x_2}} = \ldots \frac{M.V.P._{x_n y_m}}{P._{x_n}} = 1$$

where $M.V.P._{x_n y_m}$ is the marginal value productivity of resource x_n in enterprise y_m, and P_{x_n} is the price of the respective resource inputs x_1 ----- x_n. The above equation implies that each resource should be used to the point where the marginal cost of each resource just equals its marginal value productivity. If capital is limited, the more likely case, the equation is the same except that it will be greater than 1. This implies that the scarce resources should be allocated such that the marginal value productivity of each of the resources should be proportional to their prices.

The relevance of this principle in the area of credit cannot be overemphasized. Recent studies have shown[6], that

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[6] Gilson, J.C., and Yeh, M.H., "Productivity of Farm Resources in the Carman Area of Manitoba," Technical Bulletin No. 1, Department of Agricultural Economics, University of Manitoba, September, 1959.

when capital is more limiting than labour, - this is the case for most beginning farmers, - the marginal value product of capital is much higher than labour. This means that additional dollars of capital used by a young farmer short of this resource will increase his total revenue considerably.

Product-Product Principle

Every farmer has several enterprises or combinations of enterprises into which he can put his limited resources. He is concerned however, to find the optimum resource combination.

The equation for this relationship can be expressed as follows:

$$(Y_1, Y_2 \quad X_1) = 0$$

where Y_1 and Y_2 are two alternative enterprises and X_1 represents the fixed quantity of resources. For example one acre of land could produce 30 bushels of wheat or 50 bushels of oats or any combination of both. This is shown in Figure 2. The curve connecting the maximum output of wheat and oats represents all the physically possible outputs of these two crops, and is known as the product transformation function. The most profitable combination of wheat and oats is found where:

$$\frac{dW}{dO} = \frac{P_O}{P_W}$$

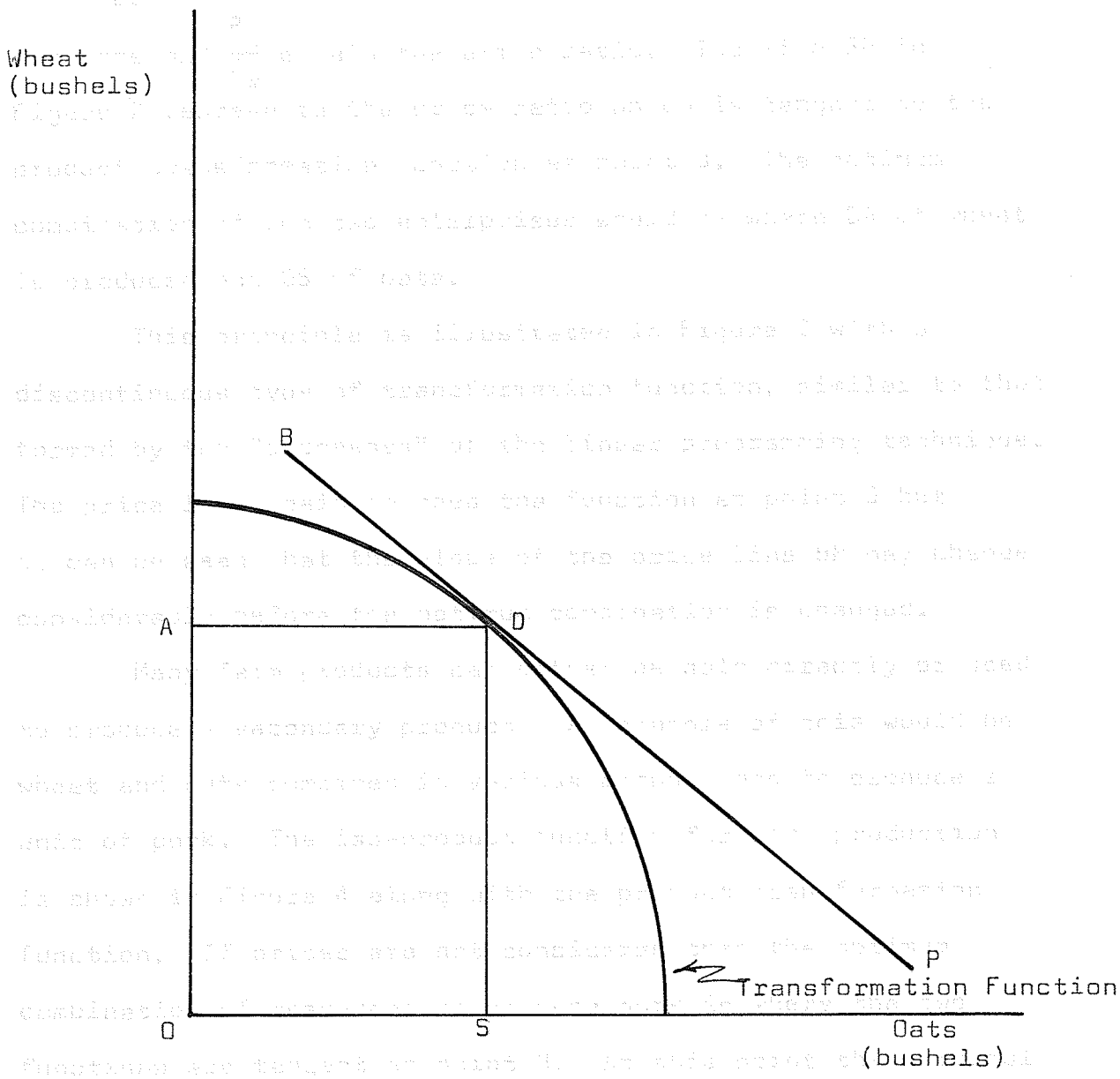

FIGURE 2

Product-Product Relationship
(continuous transformation function)

where $\frac{dW}{dO}$ equals the marginal rate of transformation of wheat for oats and $\frac{P_O}{P_W}$ equals the price ratio. The line BP in Figure 2 represents the price ratio which is tangent to the product transformation function at point D. The optimum combination of the two enterprises would be where OA of wheat is produced and OS of oats.

This principle is illustrated in Figure 3 with a discontinuous type of transformation function, similar to that formed by the "processes" of the linear programming technique. The price line again touches the function at point D but it can be seen that the slope of the price line BP may change considerably before the optimum combination is changed.

Many farm products can either be sold directly or used to produce a secondary product. An example of this would be wheat and oats combined in various proportions to produce a unit of pork. The iso-product function for pork production is shown in Figure 4 along with the product transformation function. If prices are not considered then the optimum combination of resources to produce pork is where the two functions are tangent at point N. At this point the marginal rate of transformation of wheat for oats equals the marginal rate of substitution of wheat for oats in the hog ration. This can be expressed algebraically as follows:

$$\frac{dW}{dO}\ (\text{output}) = \frac{dW}{dO}\ (\text{ration})$$

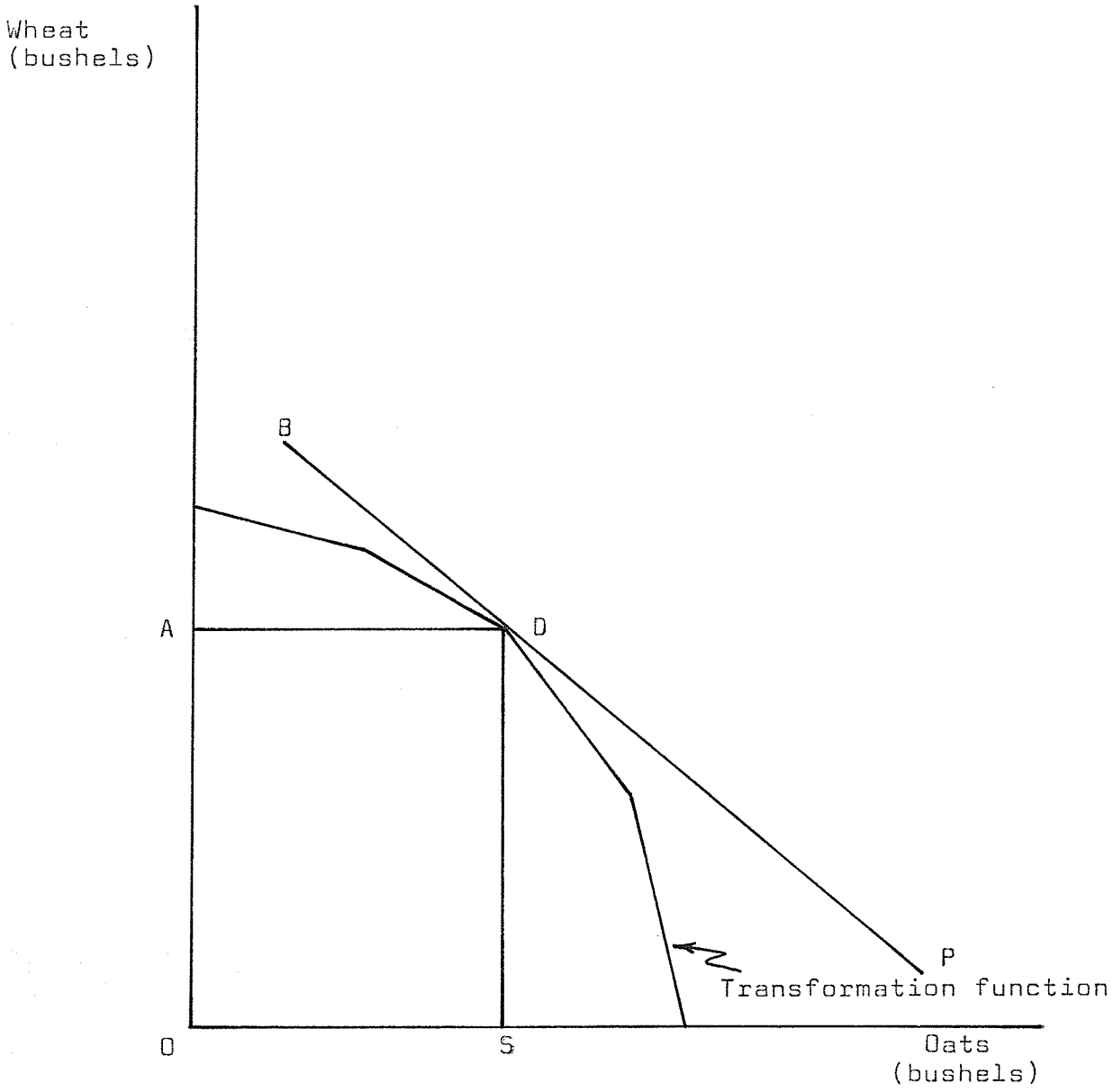

FIGURE 3

Product-Product Relationship
(discontinuous transformation function)

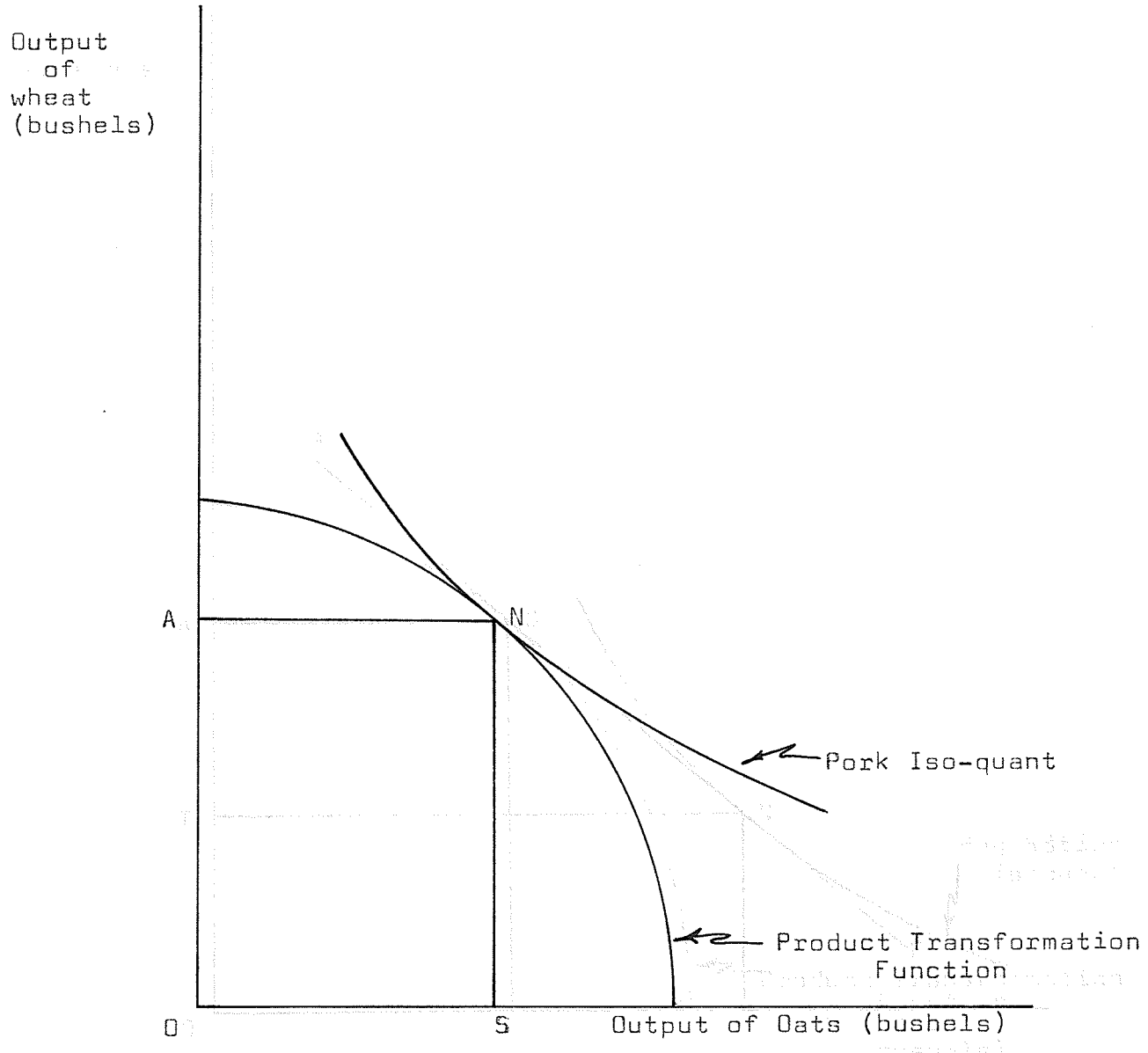

FIGURE 4

Integration of the Crop Transformation Function and the Hog Ration Isoquant

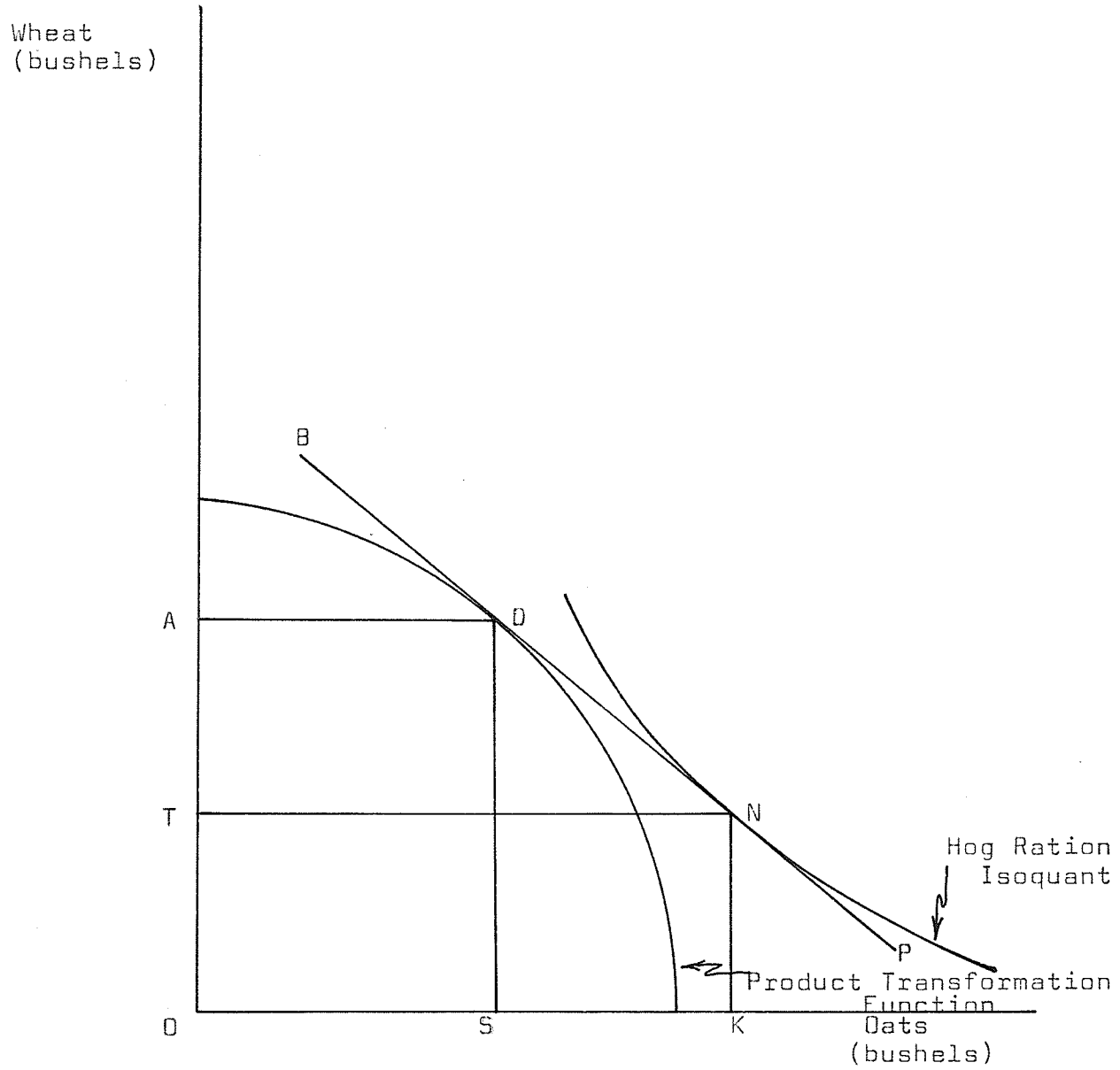

FIGURE 5

Integration of the Crop Transformation Function and the Hog Ration Isoquant with Buying and Selling Possibilities for Wheat and Oats

If the price line is introduced into Figure 4 then depending on the price ratio the situation may change considerably. Figure 5 illustrates the point. The price ratio of wheat to oats is represented by BP. If wheat and oats are produced according to their relative prices, OA of wheat and OS of oats would be produced. The amount of wheat and oats fed would be OT and OK respectively. This means that TA of wheat would be sold and SK of oats would be purchased. The principle illustrated was permitted to operate in the linear programming solutions of the empirical section of this thesis.

Factor-Product Principle

For the farmer who is using borrowed capital, or attempting to obtain extra capital, this third production principle, combined with the first two, is of utmost importance.

Shown graphically the process rays developed in Figure 1 will again be used. Four such rays are shown in Figure 6. If the level of labour is held at OB then the output of beef varies with the input of capital. It can be seen from Figure 6, that this is done by shifting from one process ray to another. If output of beef is plotted against input of capital the production function of Figure 7 results.

The price line must again be introduced shown as PP' in Figure 7 and tangent to the production function at

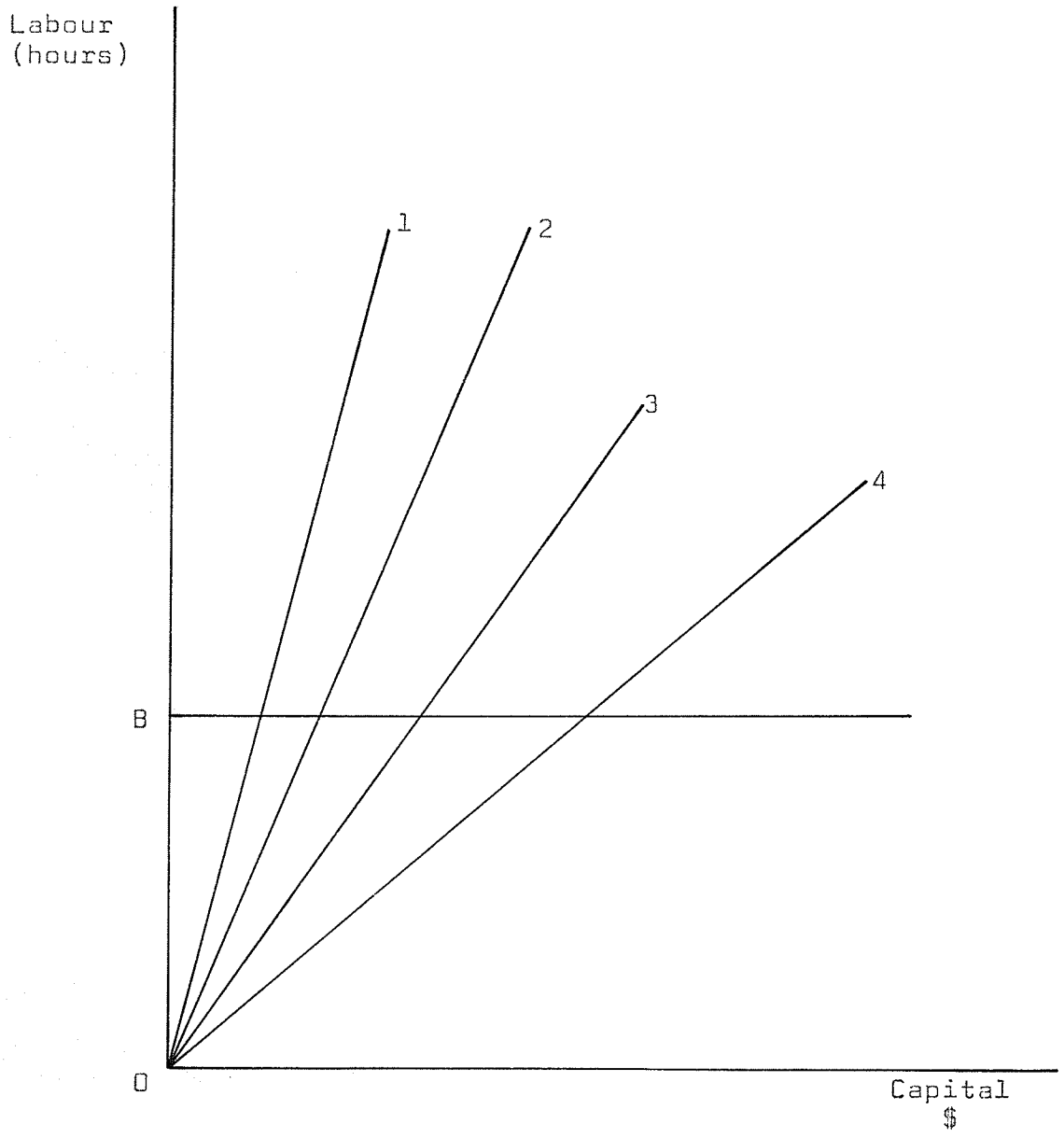

FIGURE 6

Development of Production Function

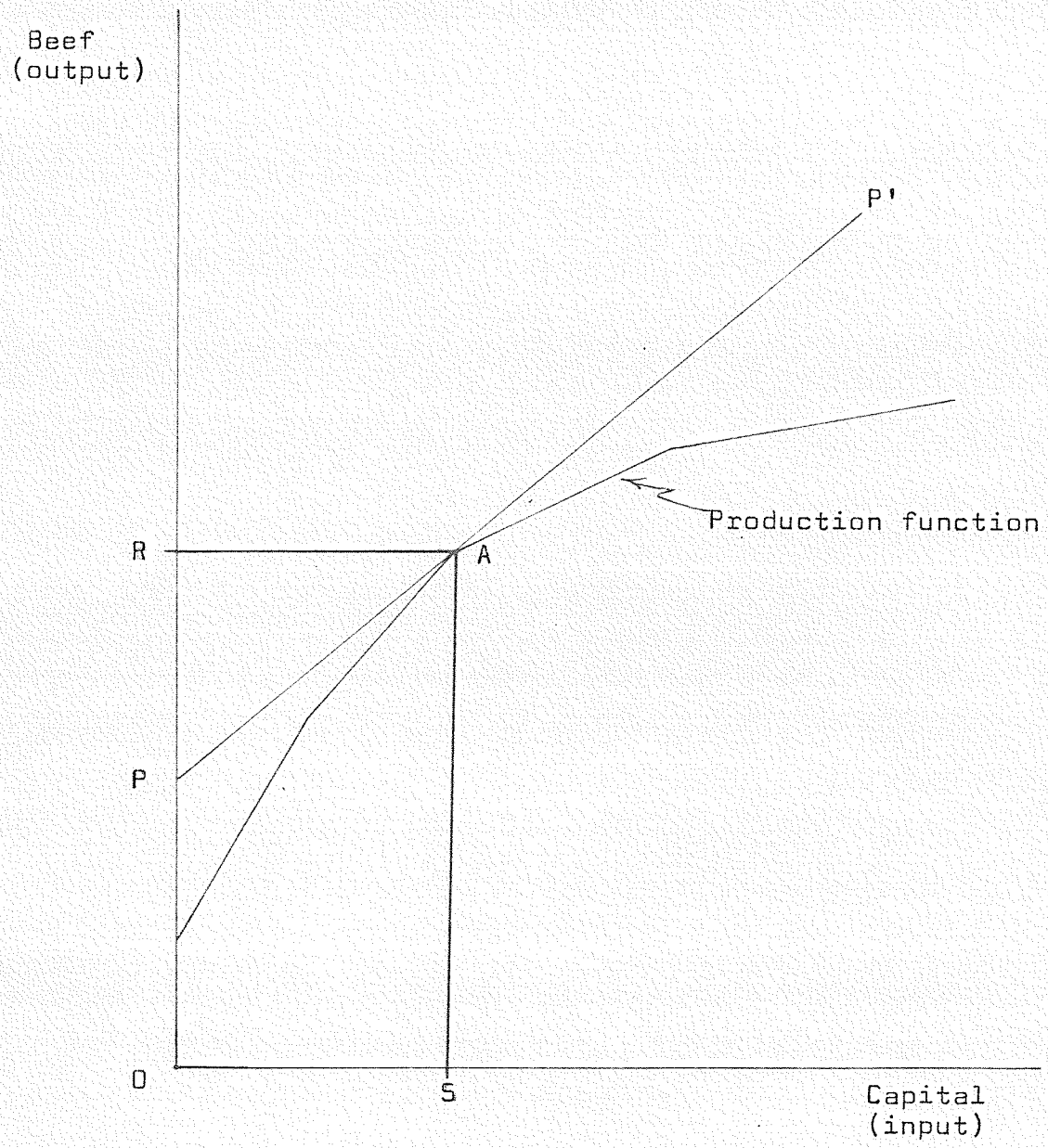

FIGURE 7

Factor-Product Principle
(discontinuous function)

point A. This is the optimum point where OR of beef is produced and OS of capital is used. The price line, as with the other two principles, can rotate considerably before the optimum point changes.

Given the technical knowledge and the assumptions relating to price, the farmer, with the use of this principle knows how much he can afford to borrow before the capital will not pay for itself. Under traditional appraisal methods this knowledge is not available. In many cases, if the farmer does not already have considerable collateral, he will not likely be able to borrow the capital required for this enterprise. There will be other cases where too much credit could be obtained; production could be increased in a particular enterprise to the point where the additional capital will not pay for itself.

MARGINAL ANALYSIS OR LINEAR PROGRAMMING

The marginal analysis technique while theoretically sound has some difficulties from a practical standpoint.

It assumes a continuous production function that varies along its entire length. The perfectly continuous production function with its everchanging slope is not a suitable basis

for decision making. For example, production decisions, which involve a reallocation of resources, cannot be changed continuously but once made will remain unchanged for a certain length of time even if the price varies considerably.

The farm firm of today is a highly complex organization where decisions of a highly technical nature and involving fairly substantial sums of money must be made. R.G.D. Allan points out regarding marginal analysis:

> It provides a neat and tidy method of exposition but it cannot pretend to produce answers to all kinds of questions on the behaviour of the firm. Alternative methods of analysis, to supplement rather than to replace the marginal approach can be sought; and it is here that the technique of linear programming and activity analysis would seem to be particularly relevant.[7]

Linear programming is more specific and more detailed in its specification of technology than is the production function of marginal analysis. Any firm has a finite number of processes that can be considered even in the long run.

The Budget Approach or Linear Programming

Comparative budget analysis has been used in agricultural economics work for many years. It has many similarities to linear programming.

A budget is a detailed production plan for a firm for

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[7]Allan, R.G.D., Mathematical Economics, (London, MacMillan and Co. Ltd., 1956), P. 619.

some future period. A firm has available a number of resources which may be used in the production plan. Some of these resources are fixed at least for the period under discussion while other resources are variable and can be increased to any required amount.

The comparative budget can be drawn up reasonably quickly if the firm is small with few alternative enterprises. This advantage is soon lost as the number of fixed resources and enterprises considered increase. It soon becomes impossible for the research worker to consider all the possible budgets and he must decide subjectively which of the many possible plans should be considered. There is always the possibility that a production plan not considered would yield a higher return than all those that have been considered.

The results found by the comparative budget approach can also be found by the systematic mathematical technique of linear programming. Although the same fixed resources and enterprises are used as in the budget, the technique does not restrict the number of possible production plans. All possible enterprise combinations are considered simultaneously; thus the plan returning the maximum profit is the one selected. Linear programming reduces the amount of computation involved and, with the use of the electronic computer, the results are obtained more rapidly. The computations involved in the

regular budget approach are not handled efficiently in the electronic computer.

Basic Concepts of Linear Programming

There are three basic concepts which are necessary for an understanding of linear programming. These are: resources, products and production processes.

Resource

A resource is defined by Robert Dorfman as:

> We may think of all the physical and intangible things used by the firm as being grouped into classes in such a way that it is a matter of indifference to this firm or any firm which member of a class it obtains for use in its productive work. Such a class we shall call a resource, a factor, or an input.[8]

An example quite relevant to this study should help to clarify this concept. A farmer has only so much labor available for the year but demands for it varies with the seasons. The labor, therefore, is not identical throughout the year. The farmer is definitely not "indifferent" as to whether he receives an additional one hundred hours of labour in the winter or in the summer, and labour must therefore be classified into groups, such that one hour of labour in any group is identical with any other hour.

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[8]Dorfman, Robert., Application of Linear Programming to the Theory of the Firm, (Berkeley and Los Angeles, The University of California Press, 1951), Page 13.

Product

The definition of a product is the same as that for a resource except that products are the result of productive effort rather than being used up in productive effort. These products are also classified into groups in such a way that an individual or firm desiring a member will be indifferent as to which member is received.[9]

Productive Process

Dorfman defines a productive process as a physical event or series of events in which men participate purposefully in order to transform some resources into products.[10] Two productive events are classified as instances of the same process if they use the same resources in the same proportions and produce the same outputs or products in the same proportions.[11]

The assumptions on which linear programming is based can now be presented. Dorfman presents three:

1. The productive opportunities of an economy or economic unit are defined by the resources and

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[9] Ibid., Page 13.

[10] Ibid., Page 14.

[11] For a mathematical exposition of a productive process see; Eyvindson, Roger K., "Economic Aspects of Farm Organization on Red River Clay," (Unpublished Master's Thesis, University of Manitoba, Winnipeg, 1961).

the productive processes available to it. The quantities of at least some of the resources are finite and so is the number of productive processes available.

2. Any productive process may be used at any positive level consistent with the supply of resources available. The consumption of resources and the output of products is proportional to the level at which the process is used.

3. Several productive processes may be used simultaneously, if the supply of resources is adequate. If this is done the consumption of each resource is the sum of the consumptions of the individual processes used, and the output of products is the sum of the outputs of the individual processes.[12]

The budget approach which was discussed briefly was based on the first assumption. This implies that some of the resources available to a firm may be unlimited while other resources have definite specified limits at least for the period under discussion. This is the usual case for a farm where land, machinery and building resources are fixed in quantity. To these fixed resources can be added variable resources such as fuel, feed and fertilizer.

The first assumption also sets out the condition which specifies that the firm is faced with a limited number of productive processes. The value of both the resources and the products, the preferences and capabilities of the entrepreneur and many other factors combine to limit the number of possible production processes.

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[12]Dorfman, Op. cit., Page 18.

The divisibility of both the products and the resources is set out in the second assumption. This means that products and resources are considered to be continuous or infinitely divisible. For example a farm plan might include 123.56 feeder hogs. If processes are divisible it follows that resources used must also be divisible. This assumption of complete divisibility is not a serious limitation because a program can ordinarily be rounded to include activities produced to the nearest whole unit without causing serious decision making errors. The second part of the assumption sets out the linear relationship of the technique. If 4 units of factor X_1 and 5 units of factor X_2 are required to produce 1 unit of output Y, then 8 units of X_1 and 10 units of X_2 will be required to produce 2 units of Y.

The third assumption points out that the processes must be additive in the sense that when two or more are used, their total product must be the sum of their individual products.

In linear programming it is commonly assumed that no complementary relationships exist. This, of course, is not the case as there are many examples which invalidate this assumption. The complementary relationship between forage and grain is one example. On a given plot of land one-half is in continuous forage production and the other half in

grain production. If the production pattern is changed so that one year the whole plot is placed in forage production and the next year in grain production then the total yield over the two year period will change. The processes, therefore, are not additive. In this situation linear programming handles the complementarity by combining both processes into one process. A process is set up for each combination of forage and grain that is to be studied. Thus a unit process of one acre containing one-eighth of an acre of grass and seven-eighths of an acre of grain is set up, and another process containing two-eighths of an acre of grass and six-eighths of an acre of grain and so on. The inputs required and the outputs which result from each of these processes can then be determined. The complementary relationship that would be found with that particular combination of the two enterprises is reflected in each process.

Heady and Candler make one more additional assumption regarding linear programming.[13] The linear programming technique assumes single-value expectations for input-output coefficients and prices. This assumption is unrealistic

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[13]Heady, E.O. and Candler, Wilfred, Linear Programming Methods (Ames, Iowa State College Press, 1958), P. 18.

for certain farming situations but Heady and Candler defend it on the grounds that it has been used by conventional research techniques including budgeting.

Definition and Explanation of Linear Programming

The assumptions and restrictions under which linear programming operates have been set out. A formal definition can now be given. Dorfman defines it as follows:

> Linear programming has been defined to be the study of the maximization or minimization of a mathematical function subject to linear inequalities.[14]

This thesis is concerned with the maximization of profit and therefore the efficient allocation of the limited resources of land, labor, building space, feed and especially capital.[15]

A short mathematical presentation of the definition will help to clarify the approach used in linear programming.[16] The linear inequalities which limit the maximization of the linear function must first be set up. For any firm there is

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[14]Dorfman, Robert, Application of Linear Programming to the Theory of the Firm (Berkeley and Los Angeles, The University of California Press, 1951,) P. 12.

[15]For detailed information on Resource Allocation see: Gilson, J.C., "An Application of Linear Programming to Farm Planning," Technical Bulletin No. 2, Dept. of Agric. Econ. University of Manitoba, March, 1960.

[16]Dorfman, Op. cit., Page 19.

a finite number of possible enterprises and a finite quantity of several resources. Every enterprise that is in the farm plan will use a certain amount of the limited resources; how much will depend on the level at which each enterprise is included in the farm plan. The given amount of any resource used by any plan can be represented by:

$$a_{d_1} X_1 + a_{d_2} X_2 + a_{d_3} X_3 + \ldots + a_{d_n} X_n = A_d$$

where A_d represents the total quantity of resource d used. X_1, X_2, X_3, ..., X_n represent the levels at which enterprises 1, 2, 3, ..., n are included in the plan. The amount of resource d required by one unit of enterprise 1 is represented by a_{d_1}, the amount of resource d required by enterprise 2 by a_{d_2} and similarly for the other terms. The above expression may be interpreted as follows: the summation of the amounts of resource d used by each enterprise equals A_d.

If there are k fixed factors then a system of equations can be developed which represents the total amount of one resource used.

The system is:

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \ldots + a_{1n}x_n = A_1$$
$$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + \ldots + a_{2n}x_n = A_2$$
$$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + \ldots + a_{3n}x_n = A_3$$
$$- - - - - - - - - - - - - - - - - - - -$$
$$a_{k1}x_1 + a_{k2}x_2 + a_{k3}x_3 + \ldots + a_{kn}x_n = A_k$$

The firm has at its disposal quantities of each of the resources which can be represented by S_1, S_2, S_3, ..., S_k. In order that the production plan will stay within its limits the following must hold:

$$\begin{aligned} A_1 &\leqslant S_1 \\ A_2 &\leqslant S_2 \\ A_3 &\leqslant S_3 \\ &- - - - - - - \\ A_k &\leqslant S_k \end{aligned}$$

The linear function is maximized within the above system of linear inequalities.

This study considers the maximization of the profit function. A net price is calculated for each of the possible enterprises 1, 2, 3, ..., n. The variable expenses are subtracted from the gross price to give the net price, which means that the net price is a return to fixed factors. The profit function is written:

$$Z = P_1x_1 + P_2x_2 + P_3x_3 + \ldots + P_nx_n$$

where x_1, x_2, x_3, ..., x_n represent the amount of enterprises 1, 2, 3, ..., n, which are included in the production plan. The P_1, P_2, P_3, ..., P_n represent the net price per unit of output of the enterprises. Z is the net return of the production plan including the enterprises at the given levels.

Linear programming selects the production plan which maximizes Z and still remains within the system of inequalities.

CHAPTER III

CRITICAL EXAMINATION OF GOVERNMENT CREDIT ACTS

In the preceding chapter the criteria for the equilibrium of the firm was shown in relation to credit appraisal. The traditional credit analysis method was evaluated in terms of the production principles for economic efficiency.

This chapter will look briefly at two credit acts and point up the inherent conflict between the operations of the acts themselves, and the criteria involved when credit is allocated within the firm according to the principles of marginal productivity analysis.

In the Agricultural Credit Act of Manitoba, section 218, subsection 1 (g) reads:

> The value of the land in respect of which the loan is made shall constitute not less than sixty percentum of the value of the total security given for the loan.[1]

What are the ramifications of this regulation? First, it will bias loaning policy in favour of land purchases. Farmers with insufficient equity collateral in land to make up the sixty per cent required will be forced to apply for a loan that includes land purchase. Depending on the particular

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[1]The Agricultural Credit Act, Province of Manitoba, Office Consolidation, 1963. (Winnipeg, R.S. Evans, Queen's Printer), Section 218, Subsection 1 (g).

area and the particular farm situation, investment of additional capital in land may be much less profitable than investment in some other farm enterprise. For example, a farmer attempting to enlarge his farm business may have two alternatives; he can purchase an additional amount of land or he can enlarge a specialized hog enterprise that already exists on his farm. The farmer may be absolutely certain that the enlarged hog enterprise will produce larger additional returns, with the limited capital, than the extra land but his present equity in land is not large enough to supply the sixty per cent land security required by the act. For example, the above farmer's land is appraised at $8,000 and he needs $10,000 to enlarge the hog enterprise. His livestock may be appraised $9,000 and machinery at $7,000 giving him a total security of $24,000. The Manitoba Agricultural Credit Corporation will only lend the farmer up to sixty-five per cent of the appraised value of the security, therefore, in order to borrow $10,000 the farmer needs $15,384 of security of which sixty per cent must be in land. Sixty per cent of $15,384 is $9,230 and the farmer's land was only appraised at $8,000, therefore, he cannot obtain the loan for the hog operation. If, however, the farmer applies for the $10,000 to purchase additional land he will have more than enough security in land to make up the required sixty per cent and will be able to obtain the loan for land purchase.

The regulation also has important implications for the entire agricultural industry. The farmer in the above example, is one of many who may be forced to acquire additional land. This means an increased demand for land and, consequently, an increase in land prices. The net result is that benefits which could accrue to the farmer because of the availability of agricultural credit might very easily be capitalized away into higher land values.

In the same Act as above section 21B, subsection 1 (f) reads:

> No loan shall be made for an amount in excess of sixty-five percentum of the value of the security given for the loan whether it is land only or land and chattels.[2]

When this regulation is considered along with the one previously discussed several effects will be evident.

A young farmer who has demonstrated his managerial ability on rented land will likely be excluded from most of the benefits of the act because of the above clause. The potential productivity of this farmer could be high.[3] If capital was made available to this farmer for investment in land, machinery, cattle, fertilizer or some combination of these and other resources, then the marginal productivity

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[2] Ibid., Section 21B, subsection 1 (f).

[3] For detailed information regarding the marginal productivity of capital and labour see, Gilson J.C. and Yeh,M.H., "Productivity of Farm Resources in the Carman Area of Manitoba," Technical Bulletin No. 1, Department of Agricultural Economics and Farm Management, University of Manitoba, September, 1959.

could be high for such a loan. However, unless the farmer can supply the difference between the sixty-five per cent appraised value of the security and the total value he cannot obtain a loan.[4] On the other hand there may be farmers with sufficient collateral to obtain a loan but because they are presently intensified to a considerable degree the additional capital yields a very low marginal productivity.

An amendment to the Agricultural Credit Act of Manitoba in 1963 makes it possible for tenants to receive loans for beef cattle breeding stock. The same principle applies here as in the case of land security. How does the appraiser for the Manitoba Agricultural Credit Corporation know whether on any particular farm the opportunities are better in breeding stock, feeder cattle or hogs?

The budget approach to credit analysis has been criticized because it is felt that the use of similar production coefficients on many farms will stereotype the kinds of loans. If a range of coefficients are used, depending on the situation and the managerial ability of the borrower, this condition can likely be avoided.

From the discussion above of the Manitoba Agricultural Credit Act, it is evident that there is pressure, implicit

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[4]The empirical work of this study indicates that when capital is limited, for each additional dollar invested by a farmer the returns are high.

in the act, in favour of certain types of loans. This can stereotype the allocation of additional capital in agriculture.

The Farm Credit Act of Canada enacted in July 1959, states in Regulation 12(2):

> Where, in the judgment of the Corporation, an applicant for a loan has the resources required to complete an economic farm unit the Corporation may decline to make a loan to him or limit the amount of the loan to be made to him.[5]

This limit has been set for the present at approximately $50,000 net worth. What criteria is used in deciding that $50,000 net worth constitutes an economic unit? This regulation could seriously hinder efficient credit allocation. A farmer who has a net worth of this amount may just be at the level in a certain enterprise where advantages of scale are beginning to accrue to him. Additional capital might be able to increase output considerably at very little extra cost. This farmer, like the young tenant farmer, may have high potential productivity but cannot take advantage of the Act.

The same criticism can be made with regard to the maximum amount of the loans. Under The Manitoba Agricultural Credit Act regulations $25,000 is the limit and under The Farm Credit Act $27,500 is the maximum loan. As pointed out

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[5]Farm Credit Act, Canadian Statutes, Chapter 43, Farm Credit Regulations pursuant to the Farm Credit Act, December 28, 1959, Regulation 12 (2).

in the introductory chapter of this study, the amount of capital invested in a present day commercial farm is very large and is increasing rapidly. Depending on the situation, the maximum amount that these two credit agencies are able to loan may be a limiting factor in efficient resource allocation.

The necessity of some kind of integration of the various types of credit; long, intermediate and short term, has been recognized by both the above mentioned credit agencies. Since the whole farm must be considered and not just one segment, loans for operating expenses may be just as important as loans for land. The empirical work of this study will show the change in profit levels due to varying the amount of operating capital. If a farmer receives a long-term loan to the limit of his security he may not be able to obtain operating capital. Banks are traditional credit appraisers which means that they, as well as the lending agencies in the long term field, will want sufficient security to adequately cover the loans they make to farmers. A major supply of the short term credit that farmers require is obtained from banks. Since the farmer above has all his security tied up in long term debt he has none left to secure short term operating capital.

The two government credit agencies mentioned above

have done much to alleviate the shortage of capital in Canadian agriculture. Substantial changes have been made in their regulations in an effort to make the acts more effective. However, as long as the main emphasis for eligibility to receive loans is on equity collateral, the economic criteria for efficient credit allocation are difficult, if not impossible to apply, within the given government credit acts.

CHAPTER IV

RECORD ANALYSIS

This chapter will be restricted to a simple record analysis. This analysis indicates strengths and weaknesses of the particular farm business chosen for this study. The directions for further budget analysis, if additional capital is to be allocated most efficiently, are indicated. As far as is possible the debt carrying capacity of the farm is also determined.

Size and financial comparisons as well as volume and efficiency comparisons will be made. As far as can be determined, the technical ability of the farmer will be compared to farmers of like size and soil type.

Crop and livestock production as well as labor and capital management will be analysed.

One question that was not answered, and cannot properly be answered by the traditional method of appraisal, was this; does the farm need extra capital or is a re-organization of the business all that is necessary? Record analysis can point up some of the strong and weak points in the farm business. It may be able to give direction to the farm reorganization and use of the extra capital.

If a farmer is applying for a loan his farming

operation should be tested to see if it is credit worthy at present. Is the farmer doing the best job possible with the resources available?

In this analysis the subject farm is compared to each of the individual comparison farms. This presents a more realistic comparison of how the farm stands in relation to similar farms. The average figures for the soil and size group of these farms are also shown in some of the tables. In the Carman District Farm Business Association, the farms are divided into 3 main soil groups with 3 sizes in each group. They are:

1. Good to excellent soils - light clays and loams.
2. Good soils - heavy clays.
3. Fair to good soils - sandy loams.

This farm is in the "Good" soil group.

Each of the individual factors in the tables can be looked at separately but many of the factors must be analysed together with other factors. The whole farm must be kept in mind at all times.

The farmer received a loan from The Manitoba Agricultural Credit Corporation of $25,000 in May, 1960. The farm will be compared on a pre-loan basis to five farms of similar size and soil type for the years 1959, 1958, 1957.

Size

For the year 1959, Farm A[1] is slightly larger in both improved and total acres than farms 1, 2, and 4 and considerably larger than farm 5 which is a rented farm. Farm 3 is a few acres larger than Farm A. (Table 4.1). Farm A has more productive Man Work Units[2] in crops than all farms except number 3.

In livestock Farm A is larger than farms 3 and 5 and only slightly smaller than the other farms.

In size then, these farms are quite similar except for farm 5 which is somewhat smaller. Farm 5 is a rented farm.

In terms of total farm receipts, Farm A is approximately $4000 higher than farms 1, 2, 4 and 5, bur nearly $10,000 less than farm 3. (Table 4.1).

Farm Income is the total farm receipts minus total farm expenses plus or minus inventory change. The variation in this figure is not nearly as large as total farm receipts. Farm A had a farm income of $3,272 which is lárger than farms 2, 4 and 5 and almost the same as farm 1. Farm 3 had a farm

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[1]For the sake of clarity the farm on which this analysis was carried out will be called Farm A. The comparison farms are numbered 1-5.

[2]A productive man work unit (P.M.W.U.) represents a 10 hour man-work-day.

Table 4.1

Size and Financial Comparison 1959

	Farm A	1	2	3	4	5 (rented)	Av. for soil Group II 20 Farms
Acres: Improved	810	640	586	879	630	465	568
Total:	880	800	772	955	640	480	634
P.M.W.U.: Crops	321	230	231	352	305	202	238
Livestock	194	210	211	158	205	182	172
Total P.M.W.U.	515	440	452	510	510	391	418
Total Receipts	$ 16427	11651	12912	25940	11725	12888	14658
Farm Income	$ 3272	3307	2543	5464	2017	3108	2874
Op. Labour Earnings	$ 1537	2355	590	2794	140	3215	1590
Real Estate	$ 30000	20750	31100	35000	44000	28800*	27196
Improvements (Invent. Change)	$ 360	-	-	1342	470	-	-
Cattle	$ 16475	6450	5000	5845	7200	5255	4943
Other Livestock	-	385	1640	90	364	650	
Grain and Feed	$ 5766	4855	11260	11126	5974	5191	6091
Supplies	$ 149	40	110	221	821	807	234
Mach. & Equipment	$ 15353	9870	13003	26049	24736	13825	13615
Total Farm Capital	$ 68403	42350	62113	79673	83565	(25728) 54528	52081
Liabilities: Long	$ 8900	5400	10000	8850	15000	-	
Int.	$ 3290	1667	-	3100	-	12200	11370
Short	$ 2526	150	-	-	8632	246	
Total	$ 14716	7217	10000	11950	23632	12446	
Net Worth	$ 60698	39425	63453	73545	93338	19837	49751
Asset-Liability Ratio	4.6	5.86	6.2	6.67	3.54	2.07	4.58
Op. Equity in Bus.	% 78	83	84	85	72	52	78
Rate Capital Turnover	4.6	3.7	5.3	4.2	7.1	2.3	4.0

*not owned.

For Farm 5 bracketed number indicates operator's equity.

income of $5,464.

Operators labour earning is the return to labour after a charge has been made for interest on average capital. Farm A is about the centre of the range of the comparison farms.

Financial Comparison

In the traditional method of appraisal much emphasis is placed on the security of the assets owned by the applicant. This is especially so in the case of land.

Record analysis places the main emphasis on productivity and efficiency and the farm is appraised on this basis.

The value of the assets owned by Farmer A (Table 4.1) is shown in relation to the comparison farms and the average for the soil group. The relatively large investment in cattle of $16,475 for Farm A is three times as large as farms 2 and 5 and approximately 2.5 times larger than Farm 4, which has $7,200 invested in cattle.

The investment in machinery and equipment on Farm A might indicate a lack of sufficient machinery to adequately handle this size of farm. This will be investigated further in efficiency comparisons.

Liabilities are classified according to length of time: long term - 6 years and over, intermediate term - 1 to 5 years, short term - under 1 year.

Farm A shows a net worth position of $60,698 which,

though considerably smaller than farm 4, is above the average of the 5 farms and well above the soil group average.

The Asset-liability ratio, Operator's equity in the business and rate of Capital turnover of Farm A are reasonably close to the 5 comparison farms and very close to the soil group average.

Technical Ability and Efficiency

Technical ability and efficiency must of necessity be analysed together. An indication of the technical ability or "know how" that the farmer possesses can be gained by comparing with others the yields per acre, value of production and amount of work required. This is shown (Table 4.2) for Farm A and comparison farms 1 to 5.

Value of livestock production for each different class of livestock is shown in relation to work involved, number of animal units,[3] total investment, value of production per $100 invested, value of production per animal unit and per work unit.

Farm A compares favourably with farms 1 to 5 in the yield per acre of wheat, oats, barley and flax. Hay yield is not too high at 1 ton per acre but ensilage corn is considerably better than that for 3 of the 4 comparison farms

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[3] An animal unit (A.U.) of livestock is a mature cow or the equivalent in other livestock from the standpoint of feed consumed and manure produced for a period of one year.

Table 4.2

Yields, Value of Production, Work Units 1959

	Farm A				Comparison Farms 1				2				3				4				5			
	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax
Crops																								
Yield/Acre	24	25	25	7.2	25	16	-	5.7	33	40	20	0	22	27	-	8.9	10	24	10	4.4	18	30	-	5
Value of Prod.	$6720	2337	435	1084	4200	1045	-	1533	7000	1716	2610	0	7588	1265	-	4206	1550	1815	348	2208	3220	3915	-	900
Work Units	100	85	10	25	60	60	-	45	75	39	49	6	125	42	-	78	55	70	20	83	65	75	-	30
Value of Prod. /Work Unit	$ 67	27	43	43	70	17	-	34	93	44	53	0	61	30	-	54	28	26	17	27	50	52	-	30

	H	C.E.	H	C.E.	H	C.E.	H	C.E.	H	C.E.	H	C.E.
Yield/Acre	1	6.6	2	3	2.2	6.7	.8	3.6	.7		4	
Value of Prod.	$ 924	1250	1440	300	880	1000	220	400	440		400	
Work Units	52	49	39	26	22	39	16	28	37		32	
Value of Prod. /Work Unit	$ 18	26	37	12	40	26	15	14	12		12	

	Farm A			Comparison Farms 1			2			3			4			5		
	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry
Livestock																		
Value of Prod.	$4990	-	-	2741	1080	398	3235	2180	170	2534	664	152	3553	1189	34	1543	1636	-
Work Units	194	-	-	149	25	36	162	50	3	131	11	16	162	25	17	144	38	-
Investment	$15397	-	-	6100	1217	150	4500	850	62	5792	381	60	5930	657	100	4950	1050	-
Value of Prod. /$100 Invest.	$32	-	-	45	89	365	72	256	274	44	174	253	60	181	34	31	156	-
No.Animal Units	50.7	-	-	31.5	7.6	1.8	30.9	13.3	.7	31	4.4	.8	27.5	9.2	1	30.7	12.2	-
Value of Prod. /Animal Units	98.4	-	-	87.0	142	-	104.7	164	-	81.7	151	-	129.2	129	-	50.3	134	-
Value of Prod. /Work Unit	26	-	-	18	43	-	20	44	-	19	60	-	22	48	-	11	40	-

H = Hay C.E. = Corn Ensilage Investment = Average value for the year

that grow corn.

Farm A had an average investment in 1959 of $15,397 in cattle. This is approximately 2.5 times larger than the largest of the comparison farms, Farm 1, which had a $6,100 investment in cattle. This investment figure must be associated with the number of animal units in cattle. Farm A had 50.7 animal units in cattle, while farm 1 had 31.5. This indicates that Farm A must have had more valuable cattle. However, the value of production per $100 invested in cattle shows Farm A to be receiving a much lower return on money invested than all farms except farm 5. (Table 4.2).

Farms 1 and 3 are receiving $45 and $44 respectively per $100 invested in cattle. Farm 4 receives $60 and Farm 2 receives $72 per $100 invested. Farm 5 at $31 return per $100 invested is only $1 less than Farm A. This indicates that the cattle operation on Farm A needs further investigation to more fully discover the cause of this low return.

Value of production per animal unit, which is one of the indicators of the farmers ability as a cattle man, shows Farmer A to be well up in the range. (Table 4.2).

Value of production per work unit indicates which crops or livestock enterprises return the most per 10 hour day. (Work unit). This figure is important in a case such as Farm A because, and it will be pointed out later, farmer A

appears to be "overworked." Producing the crop or livestock enterprise that brings the highest return for the least amount of work would be to his advantage. It will be noted (Table 4.2) that the return to wheat per time spent is consistently the highest. In the livestock enterprises hogs show a considerably higher return per work unit than cattle.

Farm A does not have any hogs on the farm, however, all the comparison farms have some hogs. The return per Animal Unit and per $100 invested in hogs shows a much faster turnover of invested capital. This is an important factor for a farmer who is trying to obtain credit.

Volume and Efficiency

Volume and efficiency comparisons are shown in both Tables 4.2 and 4.3. These tables must be analysed together in order to obtain adequate information about Farm A. Total values of crop and livestock production, crop and livestock work per man month, value of crop production per improved acre and machinery cost and investment per improved acre are shown.

A month of labor is assumed to be one man working with average efficiency at productive work for 26 ten hour days. Productive work does not include time spent repairing buildings and machinery. This means that if a man works 26 days

Table 4.3

Volume and Efficiency Comparisons 1959

	Farm A	Comparison Farms 1	2	3	4	5 (rented)	Av. for soil Group II 20 Farms
Crops							
Value Crop Prod.	$ 12750.00	8518.00	13436.00	14892.00	6610.00	7105.00	9551.00
P.M.W.U. Crops	321.00	230.00	231.00	352.00	305.00	202.00	238.00
Value Crops/Imp.acre	15.74	13.31	22.93	16.94	10.49	15.28	16.82
Power & Mach.cost/imp.acre	4.64	4.51	5.76	5.28	7.27	7.43	6.08
Mach.Inv./imp. acre	18.94	15.48	21.74	25.81	39.20	28.66	23.22
Livestock							
Value Livestock Prod.	4990.00	4219.00	5586.00	3351.00	4777.00	3180.00	4039.00
P.M.W.U. in Livestock	194.00	210.00	211.00	158.00	205.00	182.00	172.00
Value Livestock/$100 Inv.	32.41	56.51	96.85	53.26	69.37	50.88	84.95
Total Work (months)	19.8	16.9	17.4	19.6	19.6	15.0	16.1
Man Months of Labour	16.8	25.2	22.0	25.2	24.0	25.2	18.9
Crop Work/Man Mth.(days)	19.1	5.1	10.5	13.9	12.7	8.0	12.5
Lvstk. " " " "	11.5	8.3	9.6	6.2	8.5	7.2	9.1
Total " " " "	30.6	13.4	20.1	20.1	21.2	15.2	21.6

per man month then he is quite fully employed.

Total work is calculated by dividing the number of Productive Man Work Units by 26 to obtain the number of months of work required.

Farm A needs 19.8 months of work but only 16.8 are available. (Table 4.3). All the comparison farms as well as the group average show more man months of labour available than are required. This shortage of labour can again be pointed out by looking at the number of days per month in crops and livestock. Farm A has 19.1 crop work days per man month and 11.5 livestock days per man month making a total of 30.6 days per man month. This suggests that the labour on Farm A is not only fully employed but "overemployed or over-worked."

When this high labour figure is considered in relation to the low machinery investment per acre $18.94 it appears that Farmer A is trying to substitute labour for capital. The result of this could be that none of the enterprises on the farm are producing at the level they could be because of lack of time and machinery. The average machinery investment for the soil group is $23.22 per acre which is considerably above that of Farm A.

The value of crop production per improved acre is higher on Farm A than farms 1, 4 and 5 but lower than 3 and

considerably lower than 2 at $22.93 per improved acre. The average for the soil group is approximately $1 per improved acre higher than Farm A. When a farm consists of 713 improved acres every additional dollar return per improved acre adds almost $1,000 to the value of production.

Power and machinery costs per improved acre are low for Farm A at $4.64 per improved acre. This cost should not be excessively high; on the other hand, it can also be too small. The low machinery investment per acre previously explained is probably the main reason for the low costs per improved acre. This simply re-emphasizes the possibility of an insufficient amount of machinery to work properly this size of a unit.

The value of crops produced is large at $12,750 for 1959. (Table 4.3). This is near the top of the range for the comparison farms and well above the average for the soil group. Value of livestock production is higher than all the comparison farms. Farm A then has a large size volume of business.

Summary for 1959

The record analysis has provided the following information for the year 1959 about Farm A.

1. Yields per acre in grain and hay are as good as the average. Yield of ensilage corn is considerably better than average.

2. Value of production per animal unit is slightly above the average.

Points 1 and 2 give an indication that Farmer A has at least average technical ability in producing crops and livestock.

3. Value of crop and livestock production indicate that Farmer A has a larger volume of business than the average for the soil group.

Farmer A is capable of managing a fairly large sized business. Capital management and labour management must be considered together.

4. Total days work per man month is considerably larger than any of the five comparison farms or the average for the soil group.

When this is considered together with the machinery investment per acre, which is low, it would suggest that Farmer A is overworked and needs more capital invested in machinery. Part of Farm A is approximately 8 miles distance from the farm site and consolidation of the farm into a more compact unit could alleviate the shortage of labour and machinery.

5. The cattle enterprise on Farm A needs a thorough investigation.
In 1957 the value of production per $100 invested was $64. (Appendix I, Table I.2). This was the same as the return on farm 1 but higher than the other 4 farms. In 1958 the return per $100 invested was $62. This was higher than farm 5 which had a $51 return but it was considerably lower than the other 4 farms. Farm 2 had $105 return for every $100 invested in cattle. (Appendix I, Table I.5). In 1959 the returns on Farm A were lower still with Farm A receiving only $32 per $100 invested in cattle. Only farm 5 was lower at $31.

As Farmer A purchased more of the high priced purebred cattle

the return per $100 invested fell.

With the much larger investment in cattle, almost $10,000 more than the largest of the comparison farms, this operation should produce a much larger return. Budgeting might show that some consideration should be given to the possibility of changing to a different type of cattle operation such as feeders or a commercial cow-calf herd. If a feeder cattle operation replaced the present operation, Farmer A would have more time available for crop production. The records show that he needs more time to spend on crops.

The loan of $25,000 obtained by Farmer A in May, 1960, from the Manitoba Agricultural Credit Corporation was allocated as follows: $9,400 was used to remove encumbrances, build a loose housing cattle shed, and consolidate debt. The remainder of $15,600 was used for the purchase of land. As was mentioned in the previous paragraph, Farmer A has nearly $10,000 more invested in cattle than the largest of the comparison farms. If these high priced cattle could be sold and replaced with a good commercial herd then approximately $10,000 would be available for investment. This capital could have been used to build the loose housing shed, remove the encumbrances and consolidate debt. Farmer A would now only need a loan of $15,600 for the purchase of the new land. This would mean a much smaller loan re-payment per year.

Table 4.4

Inter-Year Comparisons 1957, 1958, 1959 for Farm A

	1957	1958	1959
Acres: Improved	580	820	810
Total	640	880	880
P.M.W.U.: Crops	250	352	321
Livestock	188	214	194
Total	438	571	515
Total Farm Receipts	$ 8934	13679	16427
Total Expense	$ 8939	12598	12351
Net Current Income	$ -5	1081	4076
Net Inventory Change	$ 6330	8617	-804
Farm Income	$ 6325	9698	3272
Op. Labour Earnings	$ 5080	8088	1537
Real Estate	$ 30000	30000	30000
Cattle	$ 12020	13920	16475
Hogs	$ -	-	-
Mach. & Equipment	$ 10776	14639	15353
Total Farm Capital	$ 59588	68615	68403
Liabilities: Long	$ 10700	9700	8900
Int.	$ 1108	4083	3290
Short	$ 2604	2553	2526
Total	$ 14412	16336	14716
Net Worth	$ 50982	59023	60698
Asset-Liability Ratio	4.1	4.2	4.6
Op. Equity in Bus.	% 76	76	78
Rate Capital Turnover	7.0	6.1	4.6

	1957	1958	1959
	$	$	$
Crops			
Value of Prod.	7416	14191	12750
Value Crops/imp.acre	12.79	17.30	15.74
Power & Mach.Cost/imp.acre	5.13	4.44	4.64
Mach. Invest./imp.acre	16.88	15.50	18.94
Livestock			
Value Livestock Prod.	6287	8237	4990
Total work (months)	16.8	22.0	19.8
Man months of labour	12.9	17.4	16.8
Crop work/Man Mth.(days)	19.3	20.2	19.1
Lvstk. " " " "	14.6	12.2	11.5
Total " " " "	33.9	32.4	30.6

The difference in the amount of loan re-payment could have, among other uses, been used to purchase fertilizer which would have increased yields considerably. The value of crops produced per improved acre on Farm A in 1959 was only $15.74. This is $1.08 less than the average and $7.19 less than the highest of the 5 comparison farms.

The analysis thus far has checked on the technical ability of the farmer, size and volume of business, efficiency of operation, capital management and labour management.

The three year comparison (Table 4.4) indicates some of the changes that have taken place. Cattle inventory increased fairly rapidly from $12,020 at the end of 1957 to $16,475 at the end of 1959. Total debt, though rising in 1958, returned to approximately the same level in 1959 as it had been in 1957. Value of crop production per improved acre reached $17.30 in 1958 but this was the highest and is not nearly as high as it could be. The labour record for the three years show Farmer A to be consistently overworked with not enough labour available for the amount of work which must be done.

Some of the problems of this farm business have been indicated and suggestions made for directions of change. Partial budgeting is now necessary to determine which are the most profitable changes.

Debt Carrying Capacity

What is the actual debt carrying capacity of the farm at the present time?

The comparative net current income for the years 1957, 1958 and 1959 are shown together with the inventory change. (Table 4.5). The living expenses must be subtracted from net farm income. These ranged from a low of $2,051 to a high of $2,563 with an average of approximately $2,400 per year. The income remaining after the subtraction of living expenses is the balance left for servicing debt or farm expansion.

Table 4.5. Debt Carrying Capacity of Farm A (Pre-Loan)

	Year			
	1957	1958	1959	3 Year Average
Net Current Income	-5	1081	4076	1717
Inventory Change	6330	8617	-804	4714
Net Farm Income	6325	9698	3272	6431
Average Living Expenses	2400	2400	2400	2400
Balance for Debt Payment or Expansion	3925	7298	872	4031

The three year average of the balance left for debt payment or expansion is $4,031. If $1,000 was used for expansion then the remainder of approximately $3,000 could service a debt of $45,000 at a 5.5 per cent interest rate over a 30 year period. This is the interest rate paid by

Farmer A to the Manitoba Agricultural Credit Corporation on his $25,000 loan obtained in May, 1960. An allowance must be made for year to year fluctuation as shown by the low figure of $872 for 1959.

These figures are for Farm A as presently organized. If reorganization increases net farm income then a larger balance would be available for debt payment or expansion.

CHAPTER V

ANALYTICAL PROCEDURE

The objective of the linear programming analysis is the allocation of resources according to the principles of marginal productivity. This involves the determination of the production plan which returns the maximum profit with the given resource restrictions and input-output coefficients. This chapter will present the framework of the analysis and the next chapter will analyse the results.

The case study approach has been used in this study for several reasons. The farmer is a member of the Carman District Farm Business Association so records of his farm operations are available. In 1960 the farmer received a loan from the Manitoba Agricultural Credit Corporation and this allows comparison of capital allocation as it actually took place with that determined by the linear programming analysis. The use of an existing unit that is actually operating precludes the possibility of situations arising that would not be found on an actual operating farm unit.

The actual results of the farm analysis can only be applied to the farm under consideration but the method of analysis can be used for other farm situations.

DESCRIPTION OF FARM SELECTED

Soil

Farm A is located on soil that varies over a large range; from Red River Clay to Almasippi Sand.[1] The 160 acres on which the buildings are located plus an adjoining 80 acres are a mixture of Almasippi Sand and Almasippi Loamy Sand. This soil ranges in Land Use classification from IIIds and IIIdls through IVs, Vd, and VIs.[2] IIIds soil is described as sandy soil the internal drainage of which is impeded by a heavy textured subsoil at four to twelve feet of depth. It is fairly productive under proper management. Drifting may be a problem. IIIdls soil is much the same but has the added problem of excess lime carbonate in the surface horizons. IVs soil is described as well drained soil, but has a low level of natural fertility. These soild are susceptible to erosion by wind. Vd soil is level and waterlogged but if properly managed it is quite useful for pasture and hay. VIs land is very susceptiable to wind erosion and it sometimes is difficult to establish a grass cover on this soil.

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[1]The subject farm referred to as Farm A is the same farm as in the previous Record chapter.

[2]The soil on Farm A was classified according to "land use," and the rotations used in the study were developed by Lynn B. Chambers of the Soils and Crops Branch, Manitoba Department of Agriculture.

Table 5.1. Description of Soils on Farm A.

Soil Type	Land Use Class	Description
Almasippi Clay Almasippi Loamy Sand	IIIds	Sandy soil, internal drainage impeded by a heavy textured subsoil at 4 to 12 feet of depth. Fairly productive under proper management. Drifting may be a problem.
Almasippi Clay Almasippi Loamy Sand	IIIdls	" , with added problem of excess lime carbonate in the surface horizons.
Almasippi Clay Almasippi Loamy Sand	IVs	well drained, low level of natural fertility, susceptible to wind erosion.
Almasippi Clay Almasippi Loamy Sand	Vd	level, waterlogged, quite useful for pasture and hay if properly managed.
Red River Clay and Osborne Clay	IIId	Heavy clay soil, fairly productive, internal drainage is a problem.
Red River Clay	IId to IIId	Good productivity but imperfectly drained.

The soil of this 240 acre section of Farm A requires careful management but can be fairly productive. The remainder of the farm prior to the loan, is 8 miles distance and is classified as IIId soil being Red River Clay or Osborne Clay. This land is fairly productive but internal drainage is a problem.

The 240 acres purchased in 1960, with the loan from

the Manitoba Agricultural Credit Corporation, is adjacent to the home quarter. It is mainly Red River Clay with the exception of 35 acres in one corner which is Almasippi Sand. This Red River Clay is classified as IId to IIId. IId soil is described as land of good productivity which is imperfectly drained (Table 5.1).

Farm Size

Prior to the purchase of the additional 240 acres of land in 1960, Farm A included 880 acres of land with 810 acres suitable for crop production. This is rather larger than the average farm on similar soil types. In 1959 the average size of 74 farms in this area was 536 acres with 487 acres suitable for crop production.[3] This farm would still not be considered exceedingly large for this area. In addition to this land the farmer also rented, on a cash rent basis, 240 acres of land on which he pastured some of his cattle. With the purchase of the additional 240 acres in 1960 the farm size increased to 1120 acres of which 1002 acres were suitable for crop production. The farmer rents 240 acres of the land described above of which 230 acres is suitable for crop production.

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[3] J.P. Hudson, 1959 Annual Report of the Carman District Farm Business Association, (Department of Agricultural Economics and Farm Management, University of Manitoba, June, 1960).

Enterprises on the Farms

Crops. The crops produced on Farm A were the same before receiving the loan from the Manitoba Agricultural Credit Corporation as they were after except for the introduction of 70 acres of contract peas. The introduction of the peas was not contingent on the purchase of more land but was already in the farmer's plan. The crops produced are: wheat, oats, barley, (a small amount up to 1959), flax, hay, ensilage corn and peas.

Livestock. The livestock enterprise on Farm A is a beef cow-calf operation. Approximately one-half of the herd is purebred, the other half being good commercial cattle. The operator is attempting to build up the size of the herd, the purebred heifers being kept and the purebred bulls sold at 1500 to 1600 pounds. The herd numbered 70 at the end of 1959 and was distributed as follows: milk cows 2, beef cows 27, bulls 9, heifers 10, steers 3, and calves 19.

Table 5.2. Breakdown of Livestock on Farm A, 1959 Year End.

Kind	Number
Milk Cows	2
Beef Cows	27
Bulls	9
Heifers	10
Steers	3
Calves	19
TOTAL	70

Labour Supply

The labour supply on Farm A is supplied mainly by the owner-operator with some unpaid family labour. In the busy seasons of spring and fall additional labour is hired. Total pre-loan labour supply is 4,864 hours divided into spring, summer, fall and winter in the following divisions which were determined by the farm operator. The breakdown is as follows:

Spring Labour	May 1st - June 30th
Summer Labour	July 1st - August 15th
Fall Labour	August 16th - October 15th
Winter Labour	October 16th - April 30th

After the additional land was added in 1960 there were 200 hours more summer labour supplied by the two sons.

Buildings and Machinery

Farm A has a complete complement of machinery necessary for the production of the crops and livestock enterprises on the farm. Additional equipment could probably save considerable hours of labour. The buildings for the cow-calf enterprise were hardly adequate to handle the number of cattle on the farm. Two old chicken barns had been converted to handle bulls and young calves. For the purpose of this study, $1000 was spent on converting the barn to be suitable for either hog production or cow-calf production depending on which comes into the final plan. It was assumed that there

was sufficient protection for the feeder cattle in the thick bush surrounding the farm site, therefore these two enterprises have no restriction on building space. The amount of space available for hog production in the programs is 1294 square feet, while an additional 806 square feet is available for the cow-calf operation. This has been designated as Space A and Space B respectively.

Determination of Resource Restrictions

The level at which the various resources are available is shown below. (Table 5.3).

Table 5.3. Resource Restrictions for Linear Programming

Resource	Restriction
Spring Labour	1272 hours
Summer Labour (pre-loan)	768 hours
Summer Labour (post-loan)	968 hours
Fall Labour	1248 hours
Winter Labour	1596 hours
Building Space A	1294 square feet
Building Space B	806 square feet
Home Land*	153 acres
Far Land	620 acres
New Land	192 acres
Pasture	157 acres
Capital	30,000 dollars maximum

*Note: For the purpose of this study the Almassippi Sand will be designated as "home land," the Red River and Osborne Clay of the pre-loan farm will be "far land" and the land purchased in 1960 which is mainly Red River Clay will be called "new land."

With the exception of operating capital these resources are kept as close as possible to the resources available on the

farm. Operating capital was varied from $6,000 to $22,000 and in some cases $30,000. The operator thought that he could obtain 10 to 12 thousand dollars for operating expenses. Capital requirements for hog enterprises and the cow-calf enterprise include the costs of conversion of the existing barns into suitable accommodation for these enterprises.

SELECTION OF ENTERPRISES

There are three types of enterprises in this study. They are: (1) crop rotations, (2) livestock rotations, (3) buying and selling activities.

Crop Rotations

There were twelve basic rotations developed for this study, four for each type of soil. Each rotation is unfertilized or fertilized at the recommended rate.[4] Therefore, there are 24 possible rotation processes for consideration in the linear programming analysis. The hay grown on the farm is an alfalfa-brome mixture and the corn is grown to be used as ensilage for cattle feeding. The corn is grown only on home land. A brief outline of the rotations and the land to which each rotation applies is as follows:

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[4]The rates of fertilizer application and expected yields used in this study were developed by Dr. R.A. Hedlin, Department of Soil Science, University of Manitoba. See Appendix II, Table II.1 for detailed information on fertilizer rates and crop yields.

Alternative Rotations on the Home Land

Rotation 1: A five year rotation of corn, oats, oats and seed hay, hay, hay and break.

Rotation 2: A four year rotation of corn, oats and seed hay, hay, hay and break.

Rotation 3: A five year rotation of corn, oats and seed hay, hay, hay, hay and break.

Rotation 4: A four year rotation of oats and seed hay, hay, hay, hay and break.

Alternative Rotations on the Far Land

Rotation 5: A four year rotation of wheat, flax, oats and seed clover, clover fallow.

Rotation 6: A six year rotation of wheat, flax, oats seeded, hay, hay, break and fallow.

Rotation 7: A ten year rotation of wheat, wheat, oats and seed clover, clover fallow, wheat, flax, oats seeded, hay, hay, hay and break.

Rotation 8: A six year rotation of wheat, flax, oats and seed hay, hay, hay, hay and break.

Alternative Rotations for the New Land

Rotation 9: A six year rotation of peas, oats seeded, clover fallow, wheat oats, fallow.

Rotation 10: A four year rotation of peas, wheat,

oats seeded, and clover fallow.

Rotation 11: An eight year rotation of oats, fallow, peas, oats seeded, hay, hay, hay and break, wheat.

Rotation 12: A six year rotation of hay, hay, hay, fallow, peas, oats and seed hay.

Livestock Enterprises

There are three hog enterprises developed for consideration in this study. These are a weanling pig enterprise, a farrow and feed hog enterprise, and a feeder hog enterprise. The weanling pigs are raised to 20 pounds and then sold. The farrow and feed hogs are sold at 190 pounds. Feeder hogs are purchased at 20 pounds and fed to market weight at 190 pounds. The prices are an average for the three years 1959, 1960, and 1961. It is assumed that 50 per cent Grade A and 50 per cent Grade B are marketed.

Three cattle enterprises were considered in the study. These are a cow-calf, stocker calves and feeder steers. Each cattle enterprise had a choice of a corn silage ration or a hay ration, therefore, there are six possible livestock processes for consideration in the linear programming analysis. The cow-calf enterprise sells calves at around seven months of age weighing approximately 405 pounds. The stocker calves are purchased in November and sold at the end of August weighing 1090 pounds. Feeder steers are purchased in

November at 700 pounds and sold around the middle of April at 1100 pounds.

Buying and Selling Activities

Buying and selling activities are included to permit the purchase of production resources or the marketing of surplus primary products. Selling enterprises are included for corn silage, hay, oats, wheat, flax and peas. Buying enterprises include oats, hay, and barley. Barley is not grown in the rotations presently used on Farm A or in the linear program rotations, therefore, if livestock activities are included in the final plan barley must be purchased.

Input-Output Coefficients

Each process or enterprise requires input-output coefficients. Many of these coefficients were supplied by the farmer himself. The most of the remaining coefficients were developed from the Agricultural Data Handbook.[5] Output coefficients for the crops and fertilizer inputs are shown in Appendix II, Table II.1. Labour, feed, and operating capital requirements are calculated for the livestock. Prices

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[5]"Agricultural Data Handbook," (Unpublished), Faculty of Agriculture, University of Manitoba. In addition, much assistance was given by various staff members of the Departments of Soil Science, Animal Science, Agricultural Engineering and Agricultural Economics, University of Manitoba.

for livestock output and the grain products must also be determined. The coefficients used in this study are presented in Appendix II, Table II.2 and Table II.3.[6]

Description of Programs

A total of thirty-nine programs were computed. Twenty-seven of these programs were pre-loan and the remaining twelve were post-loan. Operating capital is increased from $6,000 to $22,000 at 4,000 dollar intervals. Corn and hay selling activities are alternately included and excluded with one group of five plans, P_{11} to P_{15}, in which the corn selling activity only is excluded. Pre-loan plans are computed both with and without an interest charge on operating capital. All post-loan plans are computed with an interest charge. (Table 5.4).

One of the major hypothesis of this study is that a more efficient allocation of credit can be determined by the use of budget or productivity analysis. Therefore, the results of the final plans of the linear programming analysis, pre-loan and post-loan will be compared to the results of the actual plan of operations pre-loan and post-loan carried out by the farm operator.

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[6]Pre-loan coefficients which include an interest charge on all operating capital are not shown but are similar to the post-loan coefficients, Appendix II, Table II.3.

Table 5.4. Major Divisions of Linear Programming Plans.

Plan	Operating Capital Level (000's dollars)	Interest Charge on Operating Capital	Corn and Hay Selling Activities	Pre or Post Loan
1	6	Excluded	Included	Pre-Loan
2	10	"	"	"
3	14	"	"	"
4	18	"	"	"
5	22	"	"	"
6	6	"	Excluded	"
7	10	"	"	"
8	14	"	"	"
9	18	"	"	"
10	22	"	"	"
11	6	"	Included (Hay only)	"
12	10	"	"	"
13	14	"	"	"
14	18	"	"	"
15	22	"	"	"
16	6	Included	Included	"
17	10	"	"	"
18	14	"	"	"
19	18	"	"	"
20	22	"	"	"
21	30	"	"	"

Table 5.4. (continued)

Plan	Operating Capital Level (000's dollars)	Interest Charge on Operating Capital	Corn and Hay Selling Activities	Pre or Post Loan
22	6	Included	Excluded	Pre-Loan
23	10	"	"	"
24	14	"	"	"
25	18	"	"	"
26	22	"	"	"
27	30	"	"	"
28	6	"	Included	Post-Loan
29	10	"	"	"
30	14	"	"	"
31	18	"	"	"
32	22	"	"	"
33	30	"	"	"
34	6	"	Excluded	"
35	10	"	"	"
36	14	"	"	"
37	18	"	"	"
38	22	"	"	"
39	30	"	"	"

CHAPTER VI

ANALYSIS OF RESULTS

The results of the linear programming analysis will be presented with the aid of two main tables for each set of programs. Additional tables will present the net returns to labour, capital and management for each plan as well as compare pre-and post-loan plans both actual and budgeted.

The first table presents the optimum plan selected by the program and a financial summary for each plan. This summary includes enterprises, enterprise levels, receipts, expenses and returns. The production from the rotation enterprises is either transferred to the livestock activity or the selling activity. The second table presents data on resources available, used, sold and left over. This table also presents information as to the disposition of the crop production. In the tables the crops listed as available are the amounts produced by the rotations in the final plan. In the case of barley, which is not grown in any of the rotations, the amount listed as available is the amount purchased. (Tables 6.1 to 6.14).

To simplify the linear programming analysis, the 230 improved acres of rented land were treated as owned land with taxes charged to the operator. Therefore, the figure for

total return in the financial summary tables must be adjusted downwards by the amount of the landlord's share less taxes. This has been done (Tables 6.15, 6.16 and 6.17) as well as deducting depreciation charges and a living expense of 2,400 dollars. The resulting figure has been given the term "residual return" and is the amount remaining for expansion of the business or debt payment.[1]

The results are presented in 4 sections. They are:

1. General observations.
2. Comparison of two specific sets of plans showing changes in resource allocation as operating capital is increased.
3. Comparison of pre and post loan linear programming plans to show the marginal value product of operating capital and fixed capital.
4. Comparison of resource allocation and results of linear programming plans with the actual plans used by the farm operator.

SECTION 1

General Observations

There are 24 basic rotations in the linear programming analysis but only about one-half entered the programs. Many of those entering did so at such a level that they would be discarded in practical application. For the home land, which is mainly Almassippi sand, rotations 2, 2F, 3 and 3F are the main ones entering the optimum plans. Rotations 2

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[1] See Appendix III for a glossary of terms used in this study.

Table 6.1 Final Plan and Financial Summary for Pre-Loan Programs P_1 to P_5, Corn and Hay Selling Activities included.

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_1	R_2 ac.	149.21	ac.	-	1110.72	-1110.72
	R_5F "	367.97	"	-	3252.85	-3252.85
	R_8 "	252.03	"	-	1636.43	-1636.43
	Sell Hay	4669.75	cwt.	3455.62	-	3455.62
	Sell Oats	5260.27	bus.	2840.55	-	2840.55
	Sell Corn	298.42	tons	1492.10	-	1492.10
	Sell Wheat	3684.30	bus.	5158.02	-	5158.02
	Sell Flax	1399.33	"	4197.99	-	4197.99
	TOTAL	-		17144.27	6000.00	11144.27
P_2	R_2F ac.	153	ac.	-	1995.42	-1995.42
	R_5F "	494.54	"	-	4371.73	-4371.73
	R_8F "	125.46	"	-	1274.16	-1274.16
	Stockers-Corn	7.97	steers	1808.95	768.24	1040.71
	Cow-Calf(Hay)	52.31	cows	4139.30	1384.36	2754.94
	Hogs - F&F	1.28	hogs	42.51	14.25	28.26
	Sell Hay	3113.46	cwt.	2303.96	-	2303.96
	Sell Corn	447.69	tons	2238.45	-	2238.45
	Sell Oats	5826.18	bus.	3146.14	-	3146.14
	Sell Wheat	4200.47	"	5880.66	-	5880.66
	Sell Flax	1543.26	"	4629.78	-	4629.78
	Buy Barley	220.51	"	-	191.84	-191.84
	TOTAL	-		24189.75	10000.00	14189.75

Table 6.1 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_3	R_2F ac.	153	ac.	-	1995.44	-1995.44
	R_5F "	525.46	"	-	4645.07	-4645.07
	R_8F "	94.54	"	-	960.16	-960.16
	Stockers-Corn	42.96	steers	9754.66	4142.71	5611.95
	Cow-Calf(Hay)	52.31	cows	4139.52	1384.37	2755.15
	Hogs - F&F	1.29	hogs	42.95	14.41	28.54
	Sell Hay	1970.90	cwt.	1458.47	-	1458.47
	Sell Corn	398.01	tons	1990.05	-	1990.05
	Sell Oats	3445.22	bus.	1860.42	-	1860.42
	Sell Wheat	4275.33	"	5985.46	-	5985.46
	Sell Flax	1565.24	"	4695.72	-	4695.72
	Buy Barley	986.02	"	-	857.84	-857.84
	TOTAL	-		29927.25	14000.00	15927.25

Table 6.1 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_4	R_2F ac.	153 ac.	-	1995.44	-1995.44
	R_5F "	556.82 "	-	4922.28	-4922.28
	R_8F "	63.18 "	-	641.67	-641.67
	Stockers-Corn	76.82 steers	17444.15	7408.36	10035.79
	Cow-Calf(Hay)	51.02 cows	4037.14	1350.13	2687.01
	Hogs - F&F	10.32 hogs	342.95	114.98	227.97
	Sell Hay	887.72 cwt.	656.91	-	656.91
	Sell Corn	349.92 tons	1749.60	-	1749.60
	Sell Oats	1080.82 bus.	583.64	-	583.64
	Sell Wheat	4347.04 "	6085.86	-	6085.86
	Sell Flax	1587.54 "	4762.62	-	4762.62
	Buy Barley	1801.31 "	-	1567.14	-1567.14
	TOTAL	-	35662.87	18000.00	17662.87

Table 6.1 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_5	R_2F ac.	153 ac.	-	1995.45	-1995.45
	R_5F "	595.49 "	-	5264.14	-5264.14
	R_8F "	24.51 "	-	248.93	-248.93
	Stockers-Corn	81.64steers	18540.35	7873.90	10666.45
	Cow-Calf(Hay)	20.14 cows	1594.30	533.18	1061.12
	Hogs - F&F	225.06 hogs	7474.24	2505.94	4968.30
	Sell Hay	1268.34 cwt.	938.57	-	938.57
	Sell Corn	343.09 tons	1715.45	-	1715.45
	Sell Wheat	4339.90 bus.	6075.86	-	6075.86
	Sell Flax	1615.04 "	4845.12	-	4845.12
	Buy Barley	3681.63 "	-	3203.02	-3203.02
	Buy Oats	682.62 "	-	375.44	-375.44
	TOTAL	-	41183.89	22000.00	19183.89

Table 6.2 Resources Available, Used, Sold and Left Over, Pre-Loan Programs P_1 to P_5, Corn and Hay Selling Activities included.

Note: A negative figure in the sold row indicates purchase.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Barley (Bus.)
P_1																
Available	6,000	1272	768	1248	1576	1294	806	153	620	157	298.42	4669.75	5260.27	3684.30	1399.33	-
Used	6,000	492.25	768	642.29	210.34	-	-	149.21	620	-	-	-	-	-	-	-
Sold	-	-	-	-	-	-	-	-	-	-	298.42	4669.75	5260.27	3684.30	1399.33	-
Left Over	-	779.75	-	605.71	1365.66	1294	806	3.79	-	157	-	-	-	-	-	-
P_2																
Available	10,000	1272	768	1248	1576	1294	806	153	620	157	459	5397.47	6447.98	4200.47	1543.26	220.51
Used	10,000	626.49	768	853.61	1038.41	1294	806	153	620	157	11.31	2284.01	621.80	-	-	220.51
Sold	-	-	-	-	-	-	-	-	-	-	447.69	3113.46	5826.18	4200.47	1543.26	-
Left Over	-	645.51	-	394.39	537.59	-	-	-	-	-	-	-	-	-	-	-
P_3																
Available	14,000	1272	768	1248	1576	1294	806	153	620	157	459	4727.13	6537.11	4275.32	1565.24	986.02
Used	14,000	729.31	768	877.17	1313.04	1294	806	153	620	157	60.99	2756.23	3091.89	-	-	986.02
Sold	-	-	-	-	-	-	-	-	-	-	398.01	1970.90	3445.22	4275.32	1565.24	-
Left Over	-	542.69	-	370.83	262.96	-	-	-	-	-	-	-	-	-	-	-
P_4																
Available	18,000	1272	768	1248	1576	1294	806	153	620	157	459	4047.24	6627.53	4351.90	1587.54	1801.31
Used	18,000	832.68	768	903.55	1576	1296	806	153	620	153.12	109.08	3159.52	5546.71	4.86	-	1801.31
Sold	-	-	-	-	-	-	-	-	-	-	349.92	887.72	1080.82	4347.04	1587.54	-
Left Over	-	439.32	-	344.45	-	-	-	-	-	3.88	-	-	-	-	-	-
P_5																
Available	22,000	1272	768	1248	1576	1294	806	153	620	157	459	3208.88	6738.67	4445.56	1615.04	3681.63
Used	22,000	939.25	768	992.25	1576	1294	806	153	620	60.47	115.94	1940.54	7421.29	105.66	-	3681.63
Sold	-	-	-	-	-	-	-	-	-	-	343.06	1268.34	-682.62	4339.90	1615.04	-
Left Over	-	332.75	-	255.75	-	-	-	-	-	96.53	-	-	-	-	-	-

Table 6.3 Final Plan and Financial Summary for Pre-Loan Programs P_6 to P_{10}, Corn and Hay Selling Activities excluded.

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_6	R_5 ac.	277.94	ac.	-	1947.81	-1947.81
	R_5F "	177.18	"	-	1566.28	-1566.28
	R_8 "	164.88	"	-	1070.57	-1070.57
	Cow-Calf(Hay)	52.31	cows	4139.30	1384.37	2754.93
	Sell Oats	3818.12	bus.	2061.78	-	2061.78
	Sell Wheat	3620.65	"	5068.91	-	5068.91
	Sell Flax	1410.46	"	4231.38	-	4231.38
	Buy Barley	35.59	"	-	30.97	-30.97
	TOTAL	-		15501.37	6000.00	9501.37
P_7	R_3 ac.	103.77	ac.	-	712.91	-712.91
	R_5F "	594.91	"	-	5259.01	-5259.01
	R_8F "	25.09	"	-	254.82	-254.82
	Stockers-Corn	20.42	steers	4637.10	1969.33	2667.77
	Cow-Calf(Hay)	19.96	cows	1579.79	528.34	1051.45
	Cow-Calf(Corn)	32.35	"	2559.54	856.03	1703.51
	Sell Oats	5433.30	bus.	2349.82	-	2349.82
	Sell Wheat	4450.70	"	6221.82	-	6221.82
	Sell Flax	1616.54	"	4843.86	-	4843.86
	Buy Barley	482.25	"	-	419.56	-419.56
	TOTAL	-		22191.93	10000.00	12191.93

Table 6.3 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_8	R_3 ac.	132.92 ac.	-	913.16	-913.16
	R_5F "	589.52 "	-	5211.36	-5211.36
	R_8F "	30.48 "	-	309.55	-309.55
	Stockers-Corn	53.26steers	12095.83	5136.98	6958.85
	Cow-Calf(Hay)	19.96 cows	1579.76	528.34	1051.42
	Cow-Calf(Corn)	32.34 "	2559.54	856.02	1703.52
	Sell Oats	2187.96 bus.	1181.50	-	1181.50
	Sell Wheat	4431.10 "	6203.54	-	6203.54
	Sell Flax	1610.79 "	4832.37	-	4832.37
	Buy Barley	1200.68 "	-	1044.59	-1044.59
	TOTAL	-	28452.54	14000.00	14452.54
P_9	R_1 ac.	17.01 ac.	-	128.80	-128.80
	R_2 "	42.00 "	-	312.65	-312.65
	R_3 "	93.99 "	-	645.72	-645.72
	R_5F "	582.54 "	-	5149.66	-5149.66
	R_8F "	37.46 "	-	380.45	-380.45
	Stockers-Corn	87.72steers	19920.61	8460.08	11460.53
	Cow-Calf(Hay)	13.97 cows	1105.79	369.83	735.96
	Cow-Calf(Corn)	32.34 "	2559.54	856.02	1703.52
	Sell Wheat	4414.18 bus.	6179.85	-	6179.85
	Sell Flax	1605.82 "	4817.46	-	4817.46
	Buy Barley	1950.32 "	-	1696.79	-1696.79
	TOTAL	-	34583.25	18000.00	16583.25

Table 6.3 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{10}	R_1 ac.	37.15 ac.	-	281.30	-281.30
	R_1F "	97.73 "	-	1261.11	-1261.11
	R_4F "	18.12 "	-	209.43	-209.43
	R_5F "	620 "	-	5480.80	-5480.80
	Stockers-Corn	116.29 steers	26408.42	11215.38	15193.04
	Cow-Calf(Corn)	30.42 cows	2405.91	804.99	1600.92
	Sell Wheat	4504.92 bus.	6306.89	-	6306.89
	Sell Flax	1632.46 "	4897.38	-	4897.38
	Buy Barley	2564.40 "	-	2231.03	-2231.03
	Buy Oats	938.10 "	-	515.96	-515.96
	TOTAL	-	40018.60	22000.00	18018.60

Table 6.4 Resources Available, Used, Sold and Left Over, Pre-Loan Programs P_6 to P_{10}, Corn and Hay Selling Activities excluded.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Barley (Bus.)
P_6																
Available	6,000	1272	768	1248	1576	1294	806	153	620	157	-	2176.42	3868.33	3620.65	1410.46	35.59
Used	6,000	506.30	386.96	511.35	940.96	1286.70	806	-	620	157	-	2176.42	50.21	-	-	35.59
Sold	-	-	-	-	-	-	-	-	-	-	-	-	3818.12	3620.65	1410.46	-
Left Over	-	765.70	381.04	736.65	635.04	7.30	-	153	-	-	-	-	-	-	-	-
P_7																
Available	10,000	1272	768	1248	1576	1294	806	153	620	157	166.03	1706.18	5843.16	4444.16	1614.62	482.25
Used	10,000	659.32	410.07	675.83	1127.73	1294	798.70	103.77	620	157	166.03	1706.18	1491.64	-	-	482.25
Sold	-	-	-	-	-	-	-	-	-	-	-	-	4351.52	4444.16	1614.62	-
Left Over	-	612.68	357.93	572.17	448.27	-	7.30	49.23	-	-	-	-	-	-	-	-
P_8																
Available	14,000	1272	768	1248	1576	1294	806	153	620	157	212.67	2149.51	5998.15	4431.10	1610.79	1200.68
Used	14,000	755.67	540.71	729.11	1389.17	1294	798.70	132.92	620	157	212.67	2149.51	3810.19	-	-	1200.68
Sold	-	-	-	-	-	-	-	-	-	-	-	-	2187.96	4431.10	1610.79	-
Left Over	-	516.33	227.29	518.89	186.83	-	7.30	20.08	-	-	-	-	-	-	-	-
P_9																
Available	18,000	1272	768	1248	1576	1294	806	153	620	157	261.60	2365.29	6236.84	4414.18	1605.82	1950.32
Used	18,000	853.29	646.11	780.96	1576	1294	559.03	153	620	139.02	261.60	2365.29	6236.84	-	-	1950.32
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	4414.18	1605.82	-
Left Over	-	418.71	121.89	467.04	-	-	246.97	-	-	17.98	-	-	-	-	-	-
P_{10}																
Available	22,000	1272	768	1248	1576	1294	806	153	620	157	293.99	2134.00	7300.14	4504.92	1632.46	2564.40
Used	22,000	950.47	628.12	824.75	1576	1216.85	-	153	620	91.29	293.99	2134.00	8238.24	-	-	2564.40
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-938.10	4504.92	1632.46	-
Left Over	-	321.53	139.88	423.25	-	77.15	806	-	-	65.71	-	-	-	-	-	-

Table 6.5 Final Plan and Financial Summary for Pre-Loan Programs P_{11} to P_{15}, Corn Selling Activity excluded, Hay selling activity included.

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{11}	R_2 ac.	6.58	ac.	-	48.99	-48.99
	R_5F "	326.57	"	-	2886.88	-2886.88
	R_8F "	293.43	"	-	2980.09	-2980.09
	Cow-Calf(Corn)	3.1	cows	245.77	82.20	163.57
	Sell Oats	4507.62	bus.	2434.11	-	2434.11
	Sell Wheat	3794.23	"	5311.92	-	5311.92
	Sell Flax	1423.83	"	4271.49	-	4271.49
	Sell Hay	6363.22	cwt.	4708.78	-	4708.78
	Buy Barley	2.11	bus.	-	1.84	-1.84
	TOTAL	-		16972.07	6000.00	10972.07
P_{12}	R_3F ac.	67.25	ac.	-	863.35	-863.35
	R_5F "	422.17	"	-	3731.97	-3731.97
	R_8F "	197.83	"	-	2009.15	-2009.15
	Stockers-Corn	17.15	steers	3894.34	1653.88	2240.46
	Cow-Calf(Hay)	19.96	cows	1579.76	528.34	1051.42
	Cow-Calf(Corn)	32.35	"	2559.54	856.01	1703.52
	Sell Hay	4106.41	cwt.	3038.74	-	3038.74
	Sell Oats	4005.22	bus.	2162.82	-	2162.82
	Sell Wheat	4025.78	"	5636.09	-	5636.09
	Sell Flax	1491.80	"	4475.40	-	4475.40
	Buy Barley	410.70	"	-	357.30	-357.30
	TOTAL	-		23346.69	10000.00	13346.69

Table 6.5 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{13}	R_3F ac.	86.80 ac.	-	1114.35	-1114.35
	R_5F "	474.07 "	-	4190.79	-4190.79
	R_8F "	145.93 "	-	1482.06	-1482.06
	Stockers-Corn	50.2 1steers	11401.35	4842.05	6559.30
	Cow-Calf(Hay)	19.96 cows	1579.76	528.34	1051.42
	Cow-Calf(Corn)	32.35 "	2559.54	856.01	1703.53
	Sell Hay	2965.15 cwt.	2194.21	-	2194.21
	Sell Oats	1974.84 bus.	1066.41	-	1066.41
	Sell Wheat	4151.49 "	5812.09	-	5812.09
	Sell Flax	1528.71 "	4586.13	-	4586.13
	Buy Barley	1133.78 "	-	986.40	-986.40
	TOTAL	-	29199.49	14000.00	15199.49
P_{14}	R_3F ac.	106.50 ac.	-	1367.24	-1367.24
	R_4F "	5.04 "	-	58.24	-58.24
	R_5F "	532.43 "	-	4706.67	-4706.67
	R_8F "	87.57 "	-	889.35	-889.35
	Stockers-Corn	83.5 steers	18960.78	8052.44	10908.34
	Cow-Calf(Hay)	17.08 cows	1350.69	451.88	898.81
	Cow-Calf(Corn)	32.35 "	2559.54	856.01	1703.53
	Sell Hay	1942.76 cwt.	1437.64	-	1437.64
	Sell Wheat	4292.82 bus.	6009.95	-	6009.95
	Sell Flax	1570.20 "	4710.60	-	4710.60
	Buy Barley	1859.96 "	-	1618.17	-1618.17
	TOTAL	-	35029.20	18000.00	17029.20

Table 6.5 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{15}	R_1F ac.	122.61	ac.	-	1582.16	-1582.16
	R_4F "	30.39	"	-	351.25	-351.25
	R_5F "	569.	"	-	5029.96	-5029.96
	R_8F "	51	"	-	517.96	-517.96
	Hogs - F&F	6.23	hogs	206.78	69.33	137.45
	Stockers-Corn	113.39	steers	25749.17	10935.41	14813.76
	Cow-Calf(Corn)	31.45	cows	2488.82	832.36	1656.46
	Sell Hay	1544.18	cwt.	1142.69	-	1142.69
	Sell Wheat	4378.46	bus.	6129.84	-	6129.84
	Sell Flax	1596.20	"	4788.60	-	4788.60
	Buy Barley	2553.67	"	-	2221.69	-2221.69
	Buy Oats	836.15	"	-	459.88	-459.88
	TOTAL	-		40505.90	22000.00	18505.90

Table 6.6 Resources Available, Used, Sold and Left Over, Pre-Loan Programs P_{11} to P_{15}, Corn selling activity excluded, Hay selling activity included.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Barley (Bus.)
P_{11}																
Available	6,000	1272	768	1248	1576	1294	806	153	620	157	13.16	6420.78	4510.59	3794.23	1423.83	2.11
Used	6,000	402.07	768	499.04	224.15	124.28	-	6.58	620	9.32	13.16	57.56	2.97	-	-	2.11
Sold	-	-	-	-	-	-	-	-	-	-	-	6363.22	4507.62	3794.23	1423.83	-
Left Over	-	869.93	-	748.96	1351.85	1169.72	806	146.42	-	147.68	-	-	-	-	-	-
P_{12}																
Available	10,000	1272	768	1248	1576	1294	806	153	620	157	161.40	5768.45	5266.01	4025.78	1491.80	410.70
Used	10,000	568.32	768	663.41	1085.24	1294	798.70	67.25	620	157	161.40	1662.04	1260.79	-	-	410.70
Sold	-	-	-	-	-	-	-	-	-	-	-	4106.41	4005.22	4025.78	1491.80	-
Left Over	-	703.68	-	584.59	490.26	-	7.30	85.75	-	-	-	-	-	-	-	-
P_{13}																
Available	14,000	1272	768	1248	1576	1294	806	153	620	157	208.32	5073.36	5569.10	4151.49	1528.71	1133.78
Used	14,000	682.89	768	718.10	1373.74	1294	798.70	86.80	620	157	208.32	2108.21	3594.26	-	-	1133.78
Sold	-	-	-	-	-	-	-	-	-	-	-	2965.15	1974.84	4151.49	1528.71	-
Left Over	-	589.11	-	529.90	202.26	-	7.30	66.20	-	-	-	-	-	-	-	-
P_{14}																
Available	18,000	1272	768	1248	1576	1294	806	153	620	157	255.60	4380.12	5941.45	4292.82	1570.20	1859.96
Used	18,000	799.19	768	772	1576	1294	683.05	111.54	620	148.32	255.60	2437.36	5941.45	-	-	1859.96
Sold	-	-	-	-	-	-	-	-	-	-	-	1942.76	-	4292.82	1570.20	-
Left Over	-	472.81	-	476	-	-	22.95	41.46	-	8.68	-	-	-	-	-	-
P_{15}																
Available	22,000	1272	768	1248	1576	1294	806	153	620	157	294.26	3657.94	7243.57	4381.40	1596.20	2553.67
Used	22,000	924.11	768	826.44	1576	1294	-	153	620	94.39	294.26	2113.76	8079.72	2.94	-	2553.67
Sold	-	-	-	-	-	-	-	-	-	-	-	1544.18	-836.15	4378.46	1596.20	-
Left Over	-	347.89	-	421.56	-	-	806	-	-	62.61	-	-	-	-	-	-

Table 67 Final Plan and Financial Summary for Pre-Loan Programs P_{16} to P_{21}, Corn and Hay Selling Activities included.

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{16}	R_2 ac.	115.13 ac.	-	908.50	-908.50
	R_5F "	331.33 "	-	3104.57	-3104.57
	R_8 "	288.67 "	-	1986.93	-1986.93
	Sell Corn	230.27 tons	1151.35	-	1151.35
	Sell Hay	4846.66 cwt.	3586.53	-	3586.53
	Sell Oats	4845.51 bus.	2616.58	-	2616.58
	Sell Wheat	3565.01 "	4991.01	-	4991.01
	Sell Flax	1365.44 "	4096.32	-	4096.32
	TOTAL	-	16441.79	6000.00	10441.79
P_{17}	R_2F ac.	153.00 ac.	-	2115.08	-2115.08
	R_5F "	497.00 "	-	4656.90	-4656.90
	R_8F "	123.00 "	-	1324.11	-1324.11
	Hogs - F&F	97.32 hogs	3232.00	1195.86	2036.14
	Sell Corn	459.00 tons	2295.00	-	2295.00
	Sell Hay	5344.06 cwt.	3954.60	-	3954.60
	Sell Oats	5746.33 bus.	3103.02	-	3103.02
	Sell Wheat	4161.33 "	5825.86	-	5825.86
	Sell Flax	1545.01 "	4635.03	-	4635.03
	Buy Barley	813.86 "	-	708.05	-708.05
	TOTAL	-	23045.51	10000.00	13045.51

Table 6.7 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{18}	R_2F ac.	153.00	ac.	-	2115.08	-2115.08
	R_5F "	531.57	"	-	4980.83	-4980.83
	R_8F "	88.43	"	-	951.96	-951.96
	Hogs - F&F	225.06	hogs	7474.24	2765.53	4708.71
	Stockers-Corn	12.77	steers	2901.23	1306.03	1595.20
	Sell Corn	440.86	tons	2204.30	-	2204.30
	Sell Hay	4422.24	cwt.	3272.46	-	3272.46
	Sell Oats	4013.84	bus.	2167.47	-	2167.47
	Sell Wheat	4185.08	"	5859.11	-	5859.11
	Sell Flax	1569.59	"	4708.77	-	4708.77
	Buy Barley	2161.55	"	-	1880.57	-1880.57
	TOTAL	-		28587.58	14000.00	14587.58
P_{19}	R_2F ac.	153.00	ac.	-	2115.08	-2115.08
	R_5F "	561.01	"	-	5256.72	-5256.72
	R_8F "	58.99	"	-	635.15	-635.15
	Hogs - F&F	225.06	hogs	7474.24	2765.53	4708.71
	Stockers-Corn	46.10	steers	10469.36	4712.90	5756.46
	Sell Corn	393.54	tons	1967.70	-	1967.70
	Sell Hay	3334.42	cwt.	2467.47	-	2467.47
	Sell Oats	1746.17	bus.	942.93	-	942.93
	Sell Wheat	4256.39	"	5958.95	-	5958.95
	Sell Flax	1590.52	"	4771.56	-	4771.56
	Buy Barley	2890.52	"	-	2514.62	-2514.62
	TOTAL	-		34052.21	18000.00	16052.21

Table 6.7 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{20}	R_2F ac.	153.00 ac.	-	2115.08	-2115.08
	R_5F "	588.84 "	-	5517.50	-5517.50
	R_8F "	31.15 "	-	335.40	-335.40
	Hogs - F&F	225.06 hogs	7474.24	2765.53	4708.71
	Stockers-Corn	77.61steers	17623.81	7933.56	9690.25
	Sell Corn	348.80 tons	1744.00	-	1744.00
	Sell Hay	2306.06 cwt.	1706.48	-	1706.48
	Sell Wheat	4323.79 bus.	6053.31	-	6053.31
	Sell Flax	1610.31 "	4830.93	-	4830.93
	Buy Barley	3579.64 "	-	3114.28	-3114.28
	Buy Oats	397.54 "	-	218.65	-218.65
	TOTAL	-	39432.77	22000.00	17432.77
P_{21}	R_1F ac.	58.07 ac.	-	794.28	-794.28
	R_2F "	94.93 "	-	1312.31	-1312.31
	R_5F "	620.00 "	-	5809.40	-5809.40
	Hogs - F&F	170.29 hogs	5655.22	2092.48	3562.74
	Stockers-Corn	137.23steers	31162.31	14028.06	17134.25
	Sell Corn	229.30 tons	1146.50	-	1146.50
	Sell Hay	623.12 cwt.	461.11	-	461.11
	Sell Wheat	4424.97 bus.	6194.96	-	6194.96
	Sell Flax	1632.46 "	4897.38	-	4897.38
	Buy Barley	4425.63 "	-	3850.30	-3850.30
	Buy Oats	3842.11	-	2113.17	-2113.17
	TOTAL	-	49517.48	30000.00	19517.48

Table 6.8 Resources Available, Used, Sold and Left Over, Pre-Loan Programs P_{16} to P_{21}, Corn and Hay selling activities included.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Barley (Bus.)
P_{16}																
Available	6,000	1272	768	1248	1596	1294	806	153	620	157	230.27	4846.66	4845.51	3565.01	1365.44	-
Used	6,000	459.58	768	587.36	201.44	-	-	115.13	620	-	-	-	-	-	-	-
Sold	-	-	-	-	-	-	-	-	-	-	230.27	4846.66	4845.51	3565.01	1365.44	-
Left Over	-	812.42	-	660.64	1394.56	1294	806	37.87	-	157	-	-	-	-	-	-
P_{17}																
Available	10,000	1272	768	1248	1596	1294	806	153	620	157	459	5344.06	6455.07	4207.01	1545.01	813.86
Used	10,000	596.30	768	847.0	389.0	559.55	-	153	620	-	-	-	708.74	45.68	-	813.86
Sold	-	-	-	-	-	-	-	-	-	-	459	5344.06	5746.33	4161.33	1545.01	-
Left Over	-	675.70	-	401.0	1207.0	734.45	806	-	-	157	-	-	-	-	-	-
P_{18}																
Available	14,000	1272	768	1248	1596	1294	806	153	620	157	459	4594.66	6554.73	4290.74	1569.59	2161.55
Used	14,000	711.73	768	925.25	714.73	1294	-	153	620	-	18.14	172.42	2540.89	105.66	-	2161.55
Sold	-	-	-	-	-	-	-	-	-	-	440.86	4422.24	4013.84	4185.08	1569.59	-
Left Over	-	560.27	-	322.75	881.27	-	806	-	-	157	-	-	-	-	-	-
P_{19}																
Available	18,000	1272	768	1248	1596	1294	806	153	620	157	459	3956.40	6639.61	4362.05	1590.52	2890.52
Used	18,000	809.65	768	947.68	976.28	1294	-	153	620	-	65.46	621.98	4893.44	105.66	-	2890.52
Sold	-	-	-	-	-	-	-	-	-	-	393.54	3334.42	1746.17	4256.39	1590.52	-
Left Over	-	462.35	-	300.32	619.72	-	806	-	-	157	-	-	-	-	-	-
P_{20}																
Available	22,000	1272	768	1248	1596	1294	806	153	620	157	459	3352.84	6719.78	4429.40	1610.31	3579.64
Used	22,000	902.22	768	968.88	1223.53	1294	-	153	620	-	110.20	1046.78	7117.32	105.61	-	3579.64
Sold	-	-	-	-	-	-	-	-	-	-	348.80	2306.06	-397.54	4323.79	1610.31	-
Left Over	-	369.78	-	279.12	372.47	-	806	-	-	157	-	-	-	-	-	-
P_{21}																
Available	30,000	1272	768	1248	1596	1294	806	153	620	157	459	2474.26	7084.81	4504.92	1632.46	4425.63
Used	30,000	1049.72	768	965.27	1596	979.06	-	153	620	-	229.70	1051.14	10926.92	79.95	-	4425.63
Sold	-	-	-	-	-	-	-	-	-	-	229.30	623.12	-3842.11	4424.97	1632.46	-
Left Over	-	222.28	-	282.73	-	314.94	806	-	-	157	-	-	-	-	-	-

Table 6.9 Final Plan and Financial Summary for Pre-Loan Programs P_{22} to P_{27}, Corn and Hay Selling Activities excluded.

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{22}	R_3 ac.	7.09	ac.	-	51.62	-51.62
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	.71	cows	56.66	28.89	27.77
	Cow-Calf(Corn)	.27	cows	211.99	108.09	103.90
	Sell Oats	5346.67	bus.	2887.20	-	2887.20
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	2.31	"	-	2.00	-2.00
	TOTAL	-		14360.12	6000.00	8360.12
P_{23}	R_3 ac.	119.66	ac.	-	871.36	-871.36
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	10.37	cows	820.98	418.65	402.33
	Cow-Calf(Corn)	41.94	"	3318.53	1692.22	1626.31
	Sell Oats	5272.84	bus.	2847.33	-	2847.33
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	247.98	"	-	215.75	-215.75
	Stockers-Corn	9.71	steers	2205.02	992.62	1212.40
	TOTAL	-		20396.13	10000.00	10396.13

Table 6.9 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{24}	R_3 ac.	152.70	ac.	-	1111.99	-1111.99
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	8.29	cows	655.70	334.36	321.34
	Cow-Calf(Corn)	44.02	"	3483.82	1776.50	1707.32
	Stockers-Corn	40.71	steers	9245.49	4161.97	5083.52
	Sell Oats	3277.58	bus.	1769.89	-	1769.89
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	926.14	"	-	805.78	-805.78
	TOTAL	-		26359.17	14000.00	12359.17
P_{25}	R_3 ac.	153.00	ac.	-	1114.14	-1114.14
	R_5F "	588.36	"	-	5512.93	-5512.93
	R_8F "	31.64	"	-	340.60	-340.60
	Cow-Calf(Hay)	19.10	cows	1511.66	770.84	740.82
	Cow-Calf(Corn)	33.20	"	2627.86	1340.02	1287.84
	Stockers-Corn	73.32	steers	16650.06	7495.20	9154.86
	Sell Oats	886.40	bus.	478.66	-	478.66
	Sell Wheat	4428.28	"	6199.59	-	6199.59
	Sell Flax	1609.96	"	4829.88	-	4829.88
	Buy Barley	1639.35	"	-	1426.27	-1426.27
	TOTAL	-		32297.71	18000.00	14297.71

Table 6.9 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{26}	R_1 ac.	153.00 ac.	-	1227.97	-1227.97
	R_5F "	592.59 "	-	5552.56	-5552.56
	R_8F "	27.41 "	-	295.07	-295.07
	Hogs - F&F	158.82 hogs	5274.41	1951.58	3322.83
	Cow-Calf(Corn)	29.01 cows	2295.72	1170.65	1125.07
	Stockers-Corn	85.85steers	19494.31	8775.57	10718.74
	Sell Wheat	4364.20 bus.	6109.88	-	6109.88
	Sell Flax	1612.97 "	4838.91	-	4838.91
	Buy Barley	3225.58 "	-	2806.25	-2806.25
	Buy Oats	440.68 "	-	220.35	-220.35
	TOTAL	-	38013.23	22000.00	16013.23
P_{27}	R_1 ac.	153.00 ac.	-	1227.97	-1227.97
	R_5F "	567.67 "	-	5319.07	-5319.07
	R_8F "	52.33 "	-	563.33	-563.33
	Hogs - F&F	34.54 hogs	1147.07	424.43	722.64
	Cow-Calf(Corn)	4.12 cows	326.28	166.38	159.90
	Stockers-Corn	160.10steers	36356.86	16366.44	19990.42
	Sell Wheat	4362.00 bus.	6106.80	-	6106.80
	Sell Flax	1595.25 "	4785.75	-	4785.75
	Buy Barley	3793.61 "	-	3300.44	-3300.44
	Buy Oats	4785.34 "	-	2631.94	-2631.94
	TOTAL	-	48722.76	30000.00	18722.76

Table 6.10 Resources Available, Used, Sold and Left Over, Pre-Loan Programs P_{22} to P_{27}, Corn and Hay selling activities excluded.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Barley (Bus.)
P_{22}																
Available	6,000	1272	768	1248	1596	1294	806	153	620	157	11.34	79.40	5349.92	4504.92	1632.46	2.31
Used	6,000	514.37	117.88	506.67	244.46	135.77	-	7.09	620	10.19	11.34	79.40	3.25	-	-	2.31
Sold	-	-	-	-	-	-	-	-	-	-	-	-	5346.67	4504.92	1632.46	-
Left Over	-	757.63	650.12	741.33	1351.54	1158.23	806	145.91	-	146.81	-	-	-	-	-	-
P_{23}																
Available	10,000	1272	768	1248	1596	1294	806	153	620	157	191.46	1340.20	6008.45	4504.92	1632.46	247.98
Used	10,000	648.18	362.85	687.16	1048.62	1286.70	806	119.66	620	157	191.46	1340.20	735.61	-	-	247.98
Sold	-	-	-	-	-	-	-	-	-	-	-	-	5272.84	4504.92	1632.46	-
Left Over	-	623.82	405.15	560.84	547.38	7.30	-	33.34	-	-	-	-	-	-	-	-
P_{24}																
Available	14,000	1272	768	1248	1596	1294	806	153	620	157	244.32	1710.24	5459.00	4504.92	1632.46	926.14
Used	14,000	743.55	485.13	743.71	1296.74	1294	798.70	152.70	620	157	244.32	1710.24	2181.42	-	-	926.14
Sold	-	-	-	-	-	-	-	-	-	-	-	-	3277.58	4504.92	1632.46	-
Left Over	-	528.45	282.87	504.29	299.26	-	7.30	.30	-	-	-	-	-	-	-	-
P_{25}																
Available	18,000	1272	768	1248	1596	1294	806	153	620	157	244.80	2399.56	6112.27	4428.28	1609.96	1639.35
Used	18,000	816.34	619.99	764.23	1549.36	1294	798.70	153	620	157	244.80	2399.56	5225.87	-	-	1639.35
Sold	-	-	-	-	-	-	-	-	-	-	-	-	886.40	4428.28	1609.96	-
Left Over	-	455.66	148.01	483.77	46.64	-	7.30	-	-	-	-	-	-	-	-	-
P_{26}																
Available	22,000	1272	768	1248	1596	1294	806	153	620	157	244.80	1695.84	6843.57	4438.54	1612.97	3225.58
Used	22,000	950.61	622.11	857.85	1596	1294	779.68	153	620	87.07	244.80	1695.84	7244.25	74.34	-	3225.58
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-400.68	4364.20	1612.97	-
Left Over	-	321.39	145.89	390.15	-	-	26.32	-	-	69.93	-	-	-	-	-	-
P_{27}																
Available	30,000	1272	768	1248	1596	1294	806	153	620	157	244.80	2236.12	6771.72	4378.18	1595.25	3793.61
Used	30,000	1037.37	764.43	812.68	1596	363.50	-	153	620	12.37	244.80	2236.12	11557.06	16.18	-	3793.61
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-4785.34	4362.00	1595.25	-
Left Over	-	234.63	3.57	435.32	-	930.50	806	-	-	144.63	-	-	-	-	-	-

Table 6.11 Final Plan and Financial Summary for Post-Loan Programs P_{28} to P_{33}, Corn and Hay Selling Activities included.

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{28}	R_2 ac.	144.36 ac.	-	1139.15	-1139.15
	R_5F "	238.60 "	-	2235.68	-2235.68
	R_8 "	381.40 "	-	2625.17	-2625.17
	Sell Corn	288.72 tons	1443.60	-	1443.60
	Sell Hay	6333.68 cwt.	4686.92	-	4686.92
	Sell Wheat	3263.08 bus.	4568.31	-	4568.31
	Sell Flax	1279.67 "	3839.01	-	3839.01
	Sell Oats	4640.07 "	2505.64	-	2505.64
	TOTAL	-	17043.48	6000.00	11043.48
P_{29}	R_2F ac.	153.00 ac.	-	2115.10	-2115.10
	R_5F "	396.93 "	-	3719.25	-3719.25
	R_8F "	223.07 "	-	2401.35	-2401.35
	$R_{10}F$ "	112.87 "	-	1764.30	-1764.30
	Sell Corn	459.00 tons	2295.00	-	2295.00
	Sell Hay	7513.72 cwt.	5560.15	-	5560.15
	Sell Oats	7048.33 bus.	3806.10	-	3806.10
	Sell Wheat	4700.12 "	6580.17	-	6580.17
	Sell Flax	1473.85 "	4421.55	-	4421.55
	Sell Peas	507.93 "	1015.86	-	1015.86
	TOTAL	-	23678.83	10000.00	13678.83

Table 6.11 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{30}	R_2F ac.	153.00 ac.	-	2115.10	-2115.10
	R_5F "	428.46 "	-	4014.66	-4014.66
	R_8F "	191.54 "	-	2061.91	-2061.91
	$R_{10}F$ "	192.00 "	-	3001.15	-3001.15
	Hogs - F&F	143.49 hogs	4765.41	1763.23	3002.18
	Sell Corn	459.00 tons	2295.00	-	2295.00
	Sell Hay	6830.14 cwt.	5054.30	-	5054.30
	Sell Oats	6712.39 bus.	3624.69	-	3624.69
	Sell Wheat	5224.92 "	7314.89	-	7314.89
	Sell Flax	1496.27 "	4488.81	-	4488.81
	Sell Peas	864.00 "	1728.00	-	1728.00
	Buy Barley	1199.95 "	-	1043.95	-1043.95
	TOTAL	-	29271.10	14000.00	15271.10

Table 6.11 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{31}	R_2F ac.	153.00	ac.	-	2115.10	-2115.10
	R_5F "	461.17	"	-	4321.16	-4321.16
	R_8F "	158.83	"	-	1709.80	-1709.80
	$R_{10}F$ "	192.00	"	-	3001.15	-3001.15
	Hogs - F&F	225.06	hogs	7474.24	2765.53	4708.71
	Stockers-Corn	20.20	steers	4587.94	2065.37	2522.57
	Sell Corn	430.31	tons	2151.55	-	2151.55
	Sell Hay	5848.32	cwt.	4327.76	-	4327.76
	Sell Oats	4786.47	bus.	2584.69	-	2584.69
	Sell Wheat	5265.98	"	7372.37	-	7372.37
	Sell Flax	1519.53	"	4558.59	-	4558.59
	Sell Peas	864.00	"	1728.00	-	1728.00
	Buy Barley	2324.01	"	-	2021.89	-2021.89
	TOTAL	-		34785.14	18000.00	16785.14

Table 6.11 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{32}	R_2F ac.	153.00 ac.	-	2115.10	-2115.10
	R_5F "	490.61 "	-	4597.03	-4597.03
	R_8F "	129.39 "	-	1392.89	-1392.89
	$R_{10}F$ "	192.00 "	-	3001.15	-3001.15
	Hogs - F&F	225.06 hogs	7474.24	2765.53	4708.71
	Stockers-Corn	53.53 steers	12156.08	5472.20	6683.88
	Sell Corn	382.99 tons	1914.95	-	1914.95
	Sell Hay	4760.50 cwt.	3522.77	-	3522.77
	Sell Oats	2518.80 bus.	1360.15	-	1360.15
	Sell Wheat	5337.28 "	7472.19	-	7472.19
	Sell Flax	1540.47 "	4621.41	-	4621.41
	Sell Peas	864.00 "	1728.00	-	1728.00
	Buy Barley	3052.99 "	-	2656.10	-2656.10
	TOTAL	-	40249.79	22000.00	18249.79

Table 6.11 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{33}	R_2F ac.	153.00 ac.	-	2115.10	-2115.10
	R_5F "	543.27 "	-	5090.44	-5090.44
	R_8F "	76.73 "	-	825.99	-825.99
	$R_{10}F$ "	192.00 "	-	3001.15	-3001.15
	Hogs - F&F	225.06 hogs	7474.24	2765.53	4708.71
	Stockers-Corn	113.14steers	25692.62	11565.81	14126.81
	Sell Corn	298.35 tons	1491.75	-	1491.75
	Sell Hay	2814.78 cwt.	2082.94	-	2082.94
	Sell Wheat	5464.82 bus.	7650.75	-	7650.75
	Sell Flax	1577.91 "	4733.73	-	4733.73
	Sell Peas	864.00 "	1728.00	-	1728.00
	Buy Barley	4356.85 "	-	3790.46	-3790.46
	Buy Oats	1537.22 "	-	845.52	-845.52
	TOTAL	-	50854.03	30000.00	20854.03

Table 6.12 Resources Available, Used, Sold and Left Over, Post-Loan Programs P_{28} to P_{33}, Corn and Hay selling activities included.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Land New (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Peas (Bus.)	Barley (Bus.)
P_{28}																		
Available	6,000	1272	968	1248	1596	1294	806	153	620	192	157	288.72	6333.68	4640.07	3263.08	1279.67	-	-
Used	6,000	440.05	968	606.29	202.24	-	-	144.36	620	-	-	-	-	-	-	-	-	-
Sold	-	-	-	-	-	-	-	-	-	-	-	288.72	6333.68	4640.07	3263.08	1279.67	-	-
Left Over	-	831.95	-	641.71	1393.76	1294	806	8.64	-	192	157	-	-	-	-	-	-	-
P_{29}																		
Available	10,000	1272	968	1248	1596	1294	806	153	620	192	157	459	7513.66	7048.31	4700.10	1473.84	507.93	-
Used	10,000	571.78	968	871.01	248.03	-	-	153	620	112.87	-	-	-	-	-	-	-	-
Sold	-	-	-	-	-	-	-	-	-	-	-	459	7513.66	7048.31	4700.10	1473.84	507.93	-
Left Over	-	700.22	-	376.99	1347.97	1294	806	-	-	79.13	157	-	-	-	-	-	-	-
P_{30}																		
Available	14,000	1272	968	1248	1596	1294	806	153	620	192	157	459	6830.08	7757.37	5292.08	1496.27	864	1199.95
Used	14,000	707.87	968	1005.11	526.35	825.01	-	153	620	192	-	-	-	1044.98	67.16	-	-	1199.95
Sold	-	-	-	-	-	-	-	-	-	-	-	459	6830.08	6712.39	5224.92	1496.27	864	-
Left Over	-	564.13	-	242.89	1069.65	468.99	806	-	-	-	157	-	-	-	-	-	-	-
P_{31}																		
Available	18,000	1272	968	1248	1596	1294	806	153	620	192	157	459	6120.94	7851.67	5371.30	1519.53	864	2324.01
Used	18,000	816.97	968	1063.19	828.89	1294	-	153	620	192	-	28.69	272.62	3065.20	105.32	-	-	2324.01
Sold	-	-	-	-	-	-	-	-	-	-	-	430.31	5848.32	4786.47	5265.98	1519.53	864	-
Left Over	-	455.03	-	184.81	767.11	-	806	-	-	-	157	-	-	-	-	-	-	-
P_{32}																		
Available	22,000	1272	968	1248	1596	1294	806	153	620	192	157	459	5482.68	7936.55	5442.60	1540.46	864	3052.99
Used	22,000	914.89	968	1085.62	1090.43	1294	-	153	620	192	-	76.01	722.18	5417.75	105.32	-	-	3052.99
Sold	-	-	-	-	-	-	-	-	-	-	-	382.99	4760.50	2518.80	5337.28	1540.46	864	-
Left Over	-	357.11	-	162.38	505.57	-	806	-	-	-	157	-	-	-	-	-	-	-
P_{33}																		
Available	30,000	1272	968	1248	1596	1294	806	153	620	192	157	459	4341.00	8088.37	5570.16	1577.91	864	4356.85
Used	30,000	1090.03	968	1125.73	1558.24	1294	-	153	620	192	-	160.65	1526.22	8242.09	105.34	-	-	4356.85
Sold	-	-	-	-	-	-	-	-	-	-	-	298.35	2814.78	-153.72	5464.82	1577.91	864	-
Left Over	-	181.97	-	122.27	37.76	-	806	-	-	-	157	-	-	-	-	-	-	-

Table 6.13 Final Plan and Financial Summary for Post-Loan Programs P_{34} to P_{39}, Corn and Hay Selling Activities excluded.

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{34}	R_3 ac.	7.09	ac.	-	51.62	-51.62
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	.71	cows	56.66	28.89	27.77
	Cow-Calf(Corn)	2.67	"	211.99	108.09	103.90
	Sell Oats	5346.67	bus.	2887.20	-	2887.20
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	2.31	"	-	2.00	-2.00
	TOTAL	-		14360.12	6000.00	8360.12
P_{35}	R_3 ac.	119.67	ac.	-	871.43	-871.43
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	10.37	cows	820.79	418.55	402.24
	Cow-Calf(Corn)	41.93	"	3318.72	1692.32	1626.40
	Stockers-Corn	9.71	steers	2204.80	992.51	1212.29
	Sell Oats	5272.84	bus.	2847.33	-	2847.33
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	247.97	"	-	215.79	-215.79
	TOTAL	-		20395.91	10000.00	10395.91

Table 6.13 (continued)

Program	Enterprises	Enterprise Level		Receipts $	Expenses $	Return $
P_{36}	R_3 ac.	152.72	ac.	-	1112.10	-1112.10
	R_5F "	620.00	"	-	5809.40	-5809.40
	Cow-Calf(Hay)	8.27	cows	655.11	334.05	321.06
	Cow-Calf(Corn)	44.03	"	3484.60	1776.80	1707.80
	Stockers-Corn	40.71	steers	9245.27	4161.85	5083.42
	Sell Oats	3277.78	bus.	1770.00	-	1770.00
	Sell Wheat	4504.92	"	6306.89	-	6306.89
	Sell Flax	1632.46	"	4897.38	-	4897.38
	Buy Barley	926.11	"	-	805.80	-805.80
	TOTAL	-		26359.25	14000.00	12359.25
P_{37}	R_3 ac.	153.00	ac.	-	1114.14	-1114.14
	R_5F "	588.32	"	-	5512.55	-5512.55
	R_8F "	31.68	"	-	341.03	-341.03
	Cow-Calf(Hay)	19.10	cows	1511.66	770.83	740.83
	Cow-Calf(Corn)	33.20	"	2627.86	1340.02	1287.84
	Stockers-Corn	73.32	steers	16649.84	7495.10	9154.74
	Sell Oats	886.33	bus.	478.62	-	478.62
	Sell Wheat	4428.20	"	6199.48	-	6199.48
	Sell Flax	1609.94	"	4829.82	-	4829.82
	Buy Barley	1639.34		-	1426.33	-1426.33
	TOTAL	-		32297.28	18000.00	14297.28

Table 6.13 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{38}	R_3 ac.	153.00 ac.	-	1114.14	-1114.14
	R_5F "	587.69 "	-	5506.65	-5506.65
	R_8F "	32.31 "	-	347.81	-347.81
	$R_{10}F$ "	101.42 "	-	1585.29	-1585.29
	Cow-Calf(Hay)	15.24 cows	1206.47	615.21	591.26
	Cow-Calf(Corn)	25.19 "	1993.46	1016.52	976.94
	Stockers-Corn	97.23steers	22080.82	9939.92	12140.90
	Sell Wheat	5087.54 bus.	7122.56	-	7122.56
	Sell Flax	1609.49 "	4828.47	-	4828.47
	Sell Peas	456.40 "	912.80	-	912.80
	Buy Barley	2154.38 "	-	1874.46	-1874.46
	TOTAL	-	38144.58	22000.00	16144.58

Table 6.13 (continued)

Program	Enterprises	Enterprise Level	Receipts $	Expenses $	Return $
P_{39}	R_1 ac.	153.00 ac.	-	1227.97	-1227.97
	R_5F "	571.86 "	-	5358.32	-5358.32
	R_8F "	48.14 "	-	518.22	-518.22
	$R_{10}F$ "	192.00 "	-	3001.15	-3001.15
	Hogs - F&F	21.57 hogs	716.45	265.09	451.36
	Cow-Calf(Corn)	8.38 cows	663.32	338.24	325.08
	Stockers-Corn	147.39 steers	33470.42	15067.07	18403.35
	Sell Wheat	5629.28 bus.	7880.99	-	7880.99
	Sell Flax	1598.24 "	4794.72	-	4794.72
	Sell Peas	864.00 "	1728.00	-	1728.00
	Buy Barley	3410.04 "	-	2966.79	-2966.79
	Buy Oats	2285.74 "	-	1257.15	-1257.15
	TOTAL	-	49253.90	30000.00	19253.90

Table 6.14 Resources Available, Used, Sold and Left Over, Post-Loan Programs P_{34} to P_{39}, Corn and Hay selling activities excluded.

Plan	Capital (Dollars)	Spring Labor (Hours)	Summer Labor (Hours)	Fall Labor (Hours)	Winter Labor (Hours)	Building Space-A (Sq.ft.)	Building Space-B (Sq.ft.)	Land Home (Acres)	Land Far (Acres)	Land New (Acres)	Pasture (Acres)	Corn (Tons)	Hay (Cwt.)	Oats (Bus.)	Wheat (Bus.)	Flax (Bus.)	Peas (Bus.)	Barley (Bus.)
P_{34}																		
Available	6,000	1272	968	1248	1596	1294	806	153	620	192	157	11.34	79.41	5349.92	4504.92	1632.46	-	2.31
Used	6,000	514.37	117.88	506.67	244.46	-	135.77	7.09	620	-	10.19	11.34	79.41	3.25	-	-	-	2.31
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	5346.67	4504.92	1632.46	-	-
Left Over	-	757.63	850.12	741.33	1351.54	1294	670.23	145.91	-	192	146.81	-	-	-	-	-	-	-
P_{35}																		
Available	10,000	1272	968	1248	1596	1294	806	153	620	192	157	191.47	1340.30	6008.51	4504.92	1632.46	-	247.97
Used	10,000	648.18	362.85	687.16	1048.62	1286.70	806	119.67	620	-	157	191.47	1340.30	735.67	-	-	-	247.97
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	5272.84	4504.92	1632.46	-	-
Left Over	-	623.82	605.15	560.84	547.38	7.30	-	33.33	-	192	-	-	-	-	-	-	-	-
P_{36}																		
Available	14,000	1272	968	1248	1596	1294	806	153	620	192	157	244.35	1710.46	6201.85	4504.92	1632.46	-	926.11
Used	14,000	743.56	485.16	743.73	1296.73	1286.70	806	152.72	620	-	157	244.35	1710.46	2924.07	-	-	-	926.11
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	3277.78	4504.92	1632.46	-	-
Left Over	-	528.44	482.84	504.27	299.27	7.30	-	.28	-	192	-	-	-	-	-	-	-	-
P_{37}																		
Available	18,000	1272	968	1248	1596	1248	806	153	620	192	157	244.80	2400.42	6112.16	4428.20	1609.94	-	1639.34
Used	18,000	816.32	620.07	764.23	1549.35	1286.70	806	153	620	-	157	244.80	2400.42	5225.83	-	-	-	1639.34
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	886.33	4428.20	1609.94	-	-
Left Over	-	455.68	347.93	483.77	46.65	7.30	-	-	-	192	-	-	-	-	-	-	-	-
P_{38}																		
Available	22,000	1272	968	1248	1596	1248	806	153	620	192	157	244.80	2414.08	6902.63	5087.54	1609.49	456.40	2154.38
Used	22,000	923.75	679.69	838.97	1596	811.72	806	153	620	101.42	121.36	244.80	2414.08	6902.63	-	-	-	2154.38
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5087.54	1609.49	456.40	-
Left Over	-	348.25	288.31	409.03	-	482.28	-	-	-	90.58	35.64	-	-	-	-	-	-	-
P_{39}																		
Available	30,000	1272	968	1248	1596	1294	806	153	620	192	157	244.80	2145.28	8283.79	5639.40	1598.24	864	3410.04
Used	30,000	1116.90	754.35	937.09	1596	124.05	335.34	153	620	192	25.16	244.80	2145.28	10569.53	10.12	-	-	3410.04
Sold	-	-	-	-	-	-	-	-	-	-	-	-	-	-2285.74	5629.28	1598.24	864	-
Left Over	-	155.10	212.65	310.91	-	1169.95	470.66	-	-	-	131.84	-	-	-	-	-	-	-

Table 6.15. Pre-Loan Plans 1 to 15
Residual Return to Labour, Capital, and Management.

Plan	Operating Capital (000's dollars)	Return	Return Less L/L Share	Return Less Deprec-iation	Residual Return
		$	$	$	$
1	6	11144.27	9392.24	8144.24	5744.24
2	10	14189.75	12310.96	11062.96	8662.96
3	14	15927.25	14082.73	12834.73	10434.73
4	18	17662.87	15853.00	14605.00	12205.00
5	22	19183.89	17416.57	16168.87	13768.87
6	6	9501.37	7893.95	6645.95	4245.95
7	10	12191.93	10338.64	9090.64	6690.64
8	14	14452.54	12678.90	11430.90	9030.90
9	18	16583.25	14801.88	13553.88	11153.88
10	22	18018.60	16278.74	15030.74	12630.74
11	6	10972.07	8907.03	7659.03	5259.03
12	10	13346.69	11387.59	10139.59	7739.59
13	14	15199.49	13297.91	12049.91	9649.91
14	18	17029.20	15192.29	13944.29	11544.29
15	22	18505.90	16709.52	15461.52	13061.52

Table 6.16. Pre-Loan Plans 16 to 27
Residual Return to Labour, Capital and Management.

Plan	Operating Capital (000's dollars)	Return	Return Less L/L Share	Return Less Depreciation	Residual Return
		$	$	$	$
16	6	10441.79	8702.15	7454.15	5054.15
17	10	13045.51	11169.34	9921.34	7521.34
18	14	14587.58	12749.72	11501.72	9101.72
19	18	16052.21	14246.98	12998.98	10598.98
20	22	17432.77	15658.41	14410.41	12010.41
21	30	19517.48	17777.62	16529.62	14129.62
22	6	8360.12	6620.26	5372.26	2972.26
23	10	10396.13	8656.27	7408.27	5008.27
24	14	12359.17	10619.31	9371.31	6971.31
25	18	14297.71	12485.65	11237.65	8837.65
26	22	16013.23	14243.00	12995.00	10595.00
27	30	18722.76	16925.03	15677.03	13277.03

Table 6.17. Post-Loan Plans 28 to 39
Residual Return to Labour, Capital and Management.

Plan	Operating Capital (000's dollars)	Return	Return Less L/L Share	Return Less Deprec-iation	Residual Return
		$	$	$	$
28	6	11043.48	9303.97	7870.97	5470.97
29	10	13678.83	11691.77	10258.77	7858.77
30	14	15271.10	13318.98	11885.98	9485.98
31	18	16785.14	14869.26	13436.26	11036.26
32	22	18249.79	16366.54	14933.54	12533.54
33	30	20854.03	19029.14	17596.14	15196.14
34	6	8360.12	6620.26	5187.26	2787.26
35	10	10395.91	8656.05	7223.05	4823.05
36	14	12359.25	10619.39	9186.39	6786.39
37	18	14297.28	12522.31	11089.31	8689.31
38	22	16144.58	14370.92	12937.92	10537.92
39	30	19253.90	17460.59	16027.59	13627.59

and 2F are predominant in the plans having hay and corn selling activities because the amounts of these crops are considerably higher in these rotations. Rotations 3 and 3F enter the plans when hay and corn selling activities are excluded.

For the far land, which is Red River and Osborne clay, 5F, 8 and 8F are the only rotations entering the optimum plans. When corn and hay are sold more of 8 and 8F enter because hay is at a high level. Rotation 5 and 5F do not have any hay and this is the most important rotation.

For the new land, which is mainly Red River clay, only 10F enters the optimum plans.

Except for the home land nearly all the rotations are fertilized even at the low levels of operating capital. Under the given assumptions regarding costs and yields, fertilizer competes favourably with other inputs for the use of the limited operating capital.

Livestock generally increase in numbers as operating capital increases. Only 3 of the 6 livestock enterprises enter the plans; cow-calf, stockers and hogs farrow and feed. In plans 1 to 15, where no interest has been charged on operating capital, cow-calf and stockers are the main livestock. When interest is charged the hog activity enters the plans more frequently. In general as capital increases the number of stockers and hogs increase and the cow-calf numbers

first increase and then decrease.

SECTION 2

Comparison of Two Sets of Plans

The understanding of the following tables will be simplified by comparing the results of two specific sets of Plans. Pre-loan Plans 1 to 5 include hay and corn selling activities while pre-loan Plans 6 to 10 exclude these activities thus forcing livestock into the programs. The changes that take place as operating capital is increased are discussed using these two sets of Plans.

Plan 1

Operating capital is at the lowest level of $6,000 in P_1 and no livestock enter the Plan. (Table 6.1 and 6.2). The 4669.75 hundred weight of hay and the 298.42 tons of corn produced are sold. This plan also includes the sale of 5260.27 bushels of oats, 3,684.30 bushels of wheat and 1,399.33 bushels of flax. There are 3.79 acres of home land not in production and the 153 acres of pasture are left over. None of the 2,100 square feet of building space is used and there is considerable labour left over in every season of the year except summer where it is a limiting resource. The residual return for P_1 is 5,744 dollars. (Table 6.15).

Plan 6

Plan 6 has the same amount of operating capital as P_1 but hay and corn selling activities have been excluded. (Tables 6.3 and 6.4). The difference in resource allocation is quite marked. The home land of 153 acres is all left over but the 157 acres of pasture is used up. This is because the cow-calf operation enters the plan to the limit of the building space, 52.31 cows in total. No corn silage is produced and hay production is down from 4669.75 hundred weight to 2,176.42 hundred weight.

Approximately 100 acres more of rotation 5 and 5F, which do not include any hay production, enter Plan six than Plan one. Rotation 8, which has one of the larger amounts of hay production, is down by almost 100 acres in Plan six. The residual return for P_6 is $4,245.95 which is $1498.29 lower than Plan one.[2] (Table 6.15).

Plans 2 to 5

When operating capital is increased to $10,000 in P_2 the cow-calf enterprise enters the program to the limit of the building space,52.31 cows in total. Stocker calves also enter Plan 2 but at such a low level they would not be consid-

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[2]Under different assumptions, different rotations could have appeared in the final plans. Changes in input-output coefficients and assumptions could alter the type of rotations which would appear in the optimum plans.

ered in a practical situation. The same holds true for farrow and feed hogs.

Rotation 5F increases by 126.57 acres in P_2 over Plan 1 with the high hay yielding rotation 8F decreasing by about the same amount. As operating capital increases, stocker calves also increase in numbers with 81.64 in Plan 5 at the $22,000 operating capital level. Cow-calf numbers remain the same until Plan 5 when they drop from 51.02 down to 20.14 cows. They are replaced at this level by 225.06 farrow and feed hogs which is the limit for the building space. In P_5 the hog operation makes it necessary to purchase 3681.63 bushels of barley as well as 682.62 bushels of oats. All the oats grown on the farm, 6738.67 bushels was also fed.

Plans 7 to 10

In Plans 7 to 10, where hay and corn selling activities are excluded, the cow-calf operation enters the program at the $6,000 capital level and remains in the Plans almost to the limit of the building space until capital is raised to 18,000 dollars. This enterprise then decreases in numbers to 30.42 cows in Plan 10 while stockers, which have steadily increased from 20.42 calves in P_7 to 87.72 calves in P_9, now jump to 116.29 calves in Plan ten. (Tables 6.3 and 6.4). No hog operations enter Plans six to ten. When operating capital reaches the $10,000 level rotation 8, which is one of the high

hay yielding rotations, is at such a low level that it would likely be discarded in the practical situation. Rotation 5F, the no hay rotation, is the main crop program for the 620 acres of far land.

In Plans 1 to 5, where hay and corn selling activities are allowed, the amounts of these products sold decreases considerably as operating capital increases because the cow-calf and stocker activities enter the plans and much of the feed is consumed.

SECTION 3

Comparison of Pre and Post Loan Linear Programming Plans

Farmers are enlarging their farm units by the acquisition of additional land. It was pointed out in Chapter 3 that there is considerable pressure on farmers, because of the traditional method of credit analysis, to acquire a larger land base. This is not necessarily the most efficient allocation of limited capital. Allocation of capital to variable rather than fixed resources may produce higher marginal returns.

The empirical work of this study illustrates quite clearly that for the farm in this analysis, returns are considerably higher when additional capital is allocated into variable inputs rather than the fixed land resource. To

illustrate this point a comparison is made between pre-loan Plans and post-loan Plans.

Comparison of Pre-Loan Plans 22 to 27 and Post-Loan Plans 34 to 39

The pre-loan farm consists of 157 acres of pasture and 773 acres of cropland. The post-loan farm is exactly the same except for the addition of 192 acres of cropland which cost 15,600 dollars. This new land has been charged an interest charge of 5.5 per cent. All other resource inputs are at the same level except for the addition of 200 hours of unpaid family labour for the summer period. None of these Plans 22 to 27 and 34 to 39 have hay and corn selling activities included. This is probably more realistic than the inclusion of such activities since large amounts of hay, 3756.83 hundred weight in P_{29}, might be difficult to sell.

Some of the results of the above programs are presented in table form. (Table 6.18). The post-loan Plans have the extra 192 acres of arable land available for crop production but this land is not utilized until operating capital is between the 18 and 22 thousand dollar level. Up to this point the returns for the pre-loan and post-loan Plans are exactly the same with all the new land reamining unused.

Comparison of Pre-Loan Plans 16 to 21 and Post-Loan Plans 28 to 33

When the hay and corn selling activities are included,

Table 6.18*

Comparison of pre- and post-loan plans, Hay and Corn excluded

Pre-Loan Plans	Capital Level (000's dollars)	LAND RESOURCE (ACRES)								Return	Residual Return
		Home		Far		New		Pasture			
		Used	L.O.**	Used	L.O.	Used	L.O.	Used	L.O.	$	$
22	6	7.09	145.91	620	-	-	-	10.19	146.81	8,360.12	2,972.26
23	10	119.66	33.34	620	-	-	-	157	-	10,396.13	5,008.27
24	14	152.70	.30	620	-	-	-	157	-	12,359.17	6,971.31
25	18	153	-	620	-	-	-	157	-	14,297.71	8,837.65
26	22	153	-	620	-	-	-	87.07	69.93	16,013.23	10,595.00
27	30	153	-	620	-	-	-	12.37	144.63	18,722.76	13,277.03
Post-Loan Plans											
34	6	7.09	145.91	620	-	-	192	10.19	146.81	8,360.12	2,787.26
35	10	119.67	33.33	620	-	-	192	157	-	10,395.91	4,823.05
36	14	152.72	.28	620	-	-	192	157	-	12,359.25	6,786.39
37	18	153	-	620	-	-	192	157	-	14,297.28	8,689.31
38	22	153	-	620	-	101.42	90.58	121.36	35.64	16,144.58	10,537.92
39	30	153	-	620	-	192	-	25.16	131.84	19,253.90	13,627.59

*Derived from Tables 6.9, 6.10, 6.14, 6.16, and 6.17

**Denotes acres left over.

Plans 16 to 21 and 28 to 33, the residual returns at each capital level are not appreciably larger for the post-loan programs. (Table 6.19). At the $22,000 operating capital level, residual returns in post-loan Plan 32 are only $523.13 higher than Plan 20 which is pre-loan. Plan 32 has all the additional 192 acres of new land in operation. This means that for an investment of $15,600 in new land, the farmer would receive only $523.13 more return than if all the extra capital had not been invested.

Productivity of Fixed and Operating Capital

Under the assumptions and limitations of this study intensification of the existing farm unit, until operating capital is between 18 and 22 thousand dollars, returns the farm operator a considerably higher marginal value product for the additional capital than extending the land base. The farm under discussion used $15,600 of the $25,000 loan from the Manitoba Agricultural Credit Corporation to purchase the additional 192 acres of arable land. All other resource inputs remained at the same level with the exception of summer labour which was increased by 200 hours of unpaid family labour.

With these limitations, most of the post-loan additional income can be attributed to the fixed inputs in the added land. Additional income being the amount post-loan returns are higher than pre-loan returns, or stated another way it

Table 6.19*

Comparison of pre- and post-loan plans, Hay and Corn selling activities included

Pre-Loan Plans	Capital Level (000's dollars)	LAND RESOURCE (ACRES) Home Used	Home L.O.**	Far Used	Far L.O.	New Used	New L.O.	Pasture Used	Pasture L.O.	Return $	Residual Return $
16	6	115.13	37.87	620	-	-	-	-	157	10,441.79	5,054.15
17	10	153	-	620	-	-	-	-	157	13,045.51	7,521.34
18	14	153	-	620	-	-	-	-	157	14,587.58	9,101.72
19	18	153	-	620	-	-	-	-	157	16,052.21	10,598.98
20	22	153	-	620	-	-	-	-	157	17,432.77	12,010.41
21	30	153	-	620	-	-	-	-	157	19,517.48	14,129.62
Post-Loan Plans											
28	6	144.36	8.64	620	-	-	192	-	157	11,043.48	5,470.97
29	10	153	-	620	-	112.87	79.13	-	157	13,678.83	7,858.77
30	14	153	-	620	-	192	-	-	157	15,271.10	9,485.98
31	18	153	-	620	-	192	-	-	157	16,785.14	11,036.26
32	22	153	-	620	-	192	-	-	157	18,249.79	12,533.54
33	30	153	-	620	-	192	-	-	157	20,854.03	15,196.14

*Derived from Tables 6.7, 6.8, 6.11, 6.12, 6.16, and 6.17

**Denotes acres left over.

is the additional return to the 192 acres of new land. The marginal value product of each additional dollar of operating capital is shown for each capital level. (Table 6.20). The productivity of the added $15,600 of fixed capital is also shown, column 9. In the pre-loan Plans the MVP of operating capital decreases from $0.95 at the $6,000 capital level to $0.16 at the $30,000 capital level, column 4. The additional return to the new land, column 8, is indicated for each operating capital level. From this the productivity of the additional fixed investment in land was calculated, column 9, which started at $0.033 at the $10,000 level and rose to $0.080 at the $30,000 operating capital level.

The results indicate that at the lower levels of operating capital especially, the returns to the considerably increased investment in land are quite low. Until operating capital has reached at least the $22,000 level, allocation of additional capital into variable rather than fixed resources, would appear to be more profitable.

The above result is further strengthened if the assumption is made that only the $15,600 could be obtained and invested either in variable or fixed inputs. This means that the farm operator could either purchase the new land or add the $15,600 to the operating capital he already has available. The farmer indicated that he could obtain between 10 and 12

Table 6.20 Productivity of Operating and Fixed Capital for pre-loan Plans 16 to 21 and post-loan Plans 28 to 33. Hay and Corn Selling Activities included.

1	2	3	4	5	6	7	8	9
Plan No.	Capital Level (000's dollars)	Return Less L/L* Share	Pre-Loan M.V.P. Op. Capital	Plan No.	Return Less L/L* Share	Post-Loan M.V.P. Op. Capital	Additional Return to New Land	Productivity of Added Fixed Capital
16	6	$8702	$0.95	28	$9304	$0.95	$602	-
17	10	11169	0.40	29	11692	0.40	523	$0.033
18	14	12750	0.37	30	13319	0.40	569	0.036
19	18	14247	0.37	31	14869	0.37	623	0.040
20	22	15658	0.27	32	16367	0.37	709	0.045
21	30	17778	0.16	33	19024	0.27	1251	0.080

*L/L denotes landlord's share.

Note: Column 9 is calculated on the basis of the total $15,600 being committed even for the first acre.

thousand dollars of operating capital. If the $15,600 is added to $6,000 of the farmers own operating capital it would make a total of $21,600 or almost $22,000 of operating capital which is one of the budgeted levels in the linear programming Plans. If $10,000 of his own capital is added to the $15,600 of borrowed capital then the operating capital level would be $25,600 or almost $26,000 which is one-half way between the 22 and 30 thousand dollar levels which were also budgeted in the linear programming Plans. Now if the farmer decides instead, as he did, to put the $15,600 into the fixed land resource then he will only have 6 and 10 thousand dollars of operating capital not 22 and 26 thousand dollars. The results of adding the borrowed $15,600 to either fixed resources or variable resources are shown.(Table 6.21). Column 2 shows two levels of operating capital which

Table 6.21. Extra return if $15,600 added to operating capital rather than fixed capital. Hay and Corn selling activities included.

1	2	3	4	5
Plan No.	Operating Capital (original) (000's dollars)	Return if $15,600 added to Op. Capital $	Return if $15,600 added to Fixed Capital $	Extra Return if Additional Capital Added to Op. Capital $
16	6	15658	9304	6354
17	10	16718*	11692	5026

*Estimated return from Table 6.16.

the farmer indicated he could have had before the loan. Column 3 indicates the budgeted return if the borrowed capital is added to the operating capital already owned by the farmer. These are the returns when operating capital is 22 and 26 thousand as explained above. Column 4 shows the budgeted returns for 6 and 10 thousand dollars of operating capital respectively when the borrowed capital is invested in the 192 acres of new land. Column 5 indicates how much higher the return is if the borrowed money is allocated to operating expenses rather than into the fixed land resource. According to the linear programming budgets, the extra return is $6,354 if the borrowed $15,600 is added to $6,000 of operating capital that the farmer already has available. The extra return is $5,026 if the borrowed capital is added to $10,000 of the farmer's own operating capital, than if he invested it in additional land.

If the same two assumptions as above are applied to Plans 22 to 27 and 34 to 39 where hay and corn selling activities are excluded, the extra returns to operating capital are even larger, (Table 6.22 and 6.23). Column 5 shows the extra return.

Table 6.22 Productivity of Operating and Fixed Capital for pre-loan Plans 22 to 27 and post-loan Plans 34 to 39. Hay and Corn Selling Activities excluded.

1	2	3	4	5	6	7	8	9
Plan No.	Capital Level (000's dollars)	Return Less L/L* Share	Pre-Loan M.V.P. Op. Capital	Plan No.	Return Less L/L* Share	Post-Loan M.V.P. Op. Capital	Additional Return to New Land	Productivity of Added Fixed Capital
22	6	$6620	$0.52	34	$6620	$0.52	0	-
23	10	8656	0.49	35	8656	0.49	0	-
24	14	10619	0.49	36	10619	0.49	0	-
25	18	12486	0.48	37	12522	0.48	$36	-
26	22	14243	0.34	38	14371	0.45	128	$0.008
27	30	16925	0.34	39	17461	0.34	536	0.034

*L/L denotes landlord's share.

Note: Column 9 is calculated on the basis of the total $15,600 being committed even for the first acre.

Table 6.23. Extra return if $15,600 added to operating capital rather than fixed capital.
Hay and Corn selling activities excluded.

1	2	3	4	5
Plan No.	Operating Capital (original) (000's dollars)	Return if $15,600 added to Op. Capital $	Return if $15,600 added to Fixed Capital $	Extra Return if Additional Capital Added to Op. Capital $
22	6	14243	6620	7623
23	10	15584*	8656	6928

*Estimated return from Table 6.16.

SECTION 4

Comparison of Linear Programming Plans with Actual Plans

In order to make the linear program plans comparable with the actual plans of operation used by the farmer it was necessary to make some adjustments in the farm records.

In the linear programs the livestock entered the plans at the zero level and increased as the operating capital increased. The beef breeding herd existed on the farm in 1959 so it was necessary to charge a replacement cost on the mature cows. Interest on operating capital was also charged at the same rate as in the linear programming plans.

Actual Allocation of the Loan by the Farmer

The actual allocation of the loan obtained from the Manitoba Agricultural Credit Corporation in 1960 was explained

in the record analysis of Chapter IV. It will be compared here to the allocation proposed in the budget Plans.

The removal of encumbrances and the consolidation of debt required $7,500 of the $25,000 loan. A loose housing cattle shed required $1,900 and the remainder of $15,600 was used to purchase the new land.

The results of the pre and post-loan actual plans are shown below. (Table 6.24).

Table 6.24. Results of Pre and Post-Loan Actual Plans

	Capital Level	Land Used (Acres)				Return	Residual Return
		Home	Far	New	Pasture		
Pre-loan	$5751	153	620	-	157	$3272	$ 872
Post loan	$7100	153	620	192	157	$7982	$5582

The "return" in the above table is the net current income plus or minus inventory change. The inventory change includes a depreciation charge on machinery and improvements. The "residual return" is the return minus a $2,400 living expense. This is the return to labour, management and fixed capital and can be used for debt payment and business expansion.

Comparison of the budgeted plans, which use average yield and price figures, to the results of one year's operation are difficult. Yields and prices can vary considerably from

one year to the next causing substantial variations in income. This was clearly illustrated in Chapter IV. (Table 4.5).

Operating capital in 1959 was 5751 dollars. All the land and pasture were used and the residual return was 872 dollars.

The post-loan actual operation has a total of $7,100 of operating capital and the residual return is 5582 dollars.

Proposed Allocation of the Loan

In general the budget Plans allocate the loan to fertilizer and more livestock including cow-calf, stockers and farrow and feed hogs. If hay and corn selling activities are excluded, as in post-loan Plans 34 to 39, (Table 6.18), the budget Plans do not allocate the loan for new land purchases until operating capital has reached a fairly high level.

In the linear programming Plans not all the home land is used at certain levels of capital. (Tables 6.18 and 6.19). Plan 16 indicates 37.87 acres left over at the $6,000 level while Plans 22 and 34 have 145.91 acres each of home land left over.

The pre-loan budget Plans with operating capital at the $6,000 level, the closest to the actual level, and including an interest charge are numbers P_{16} and P_{22}. P_{16} includes hay and corn selling activities while P_{22} excludes

these activities. The comparable post-loan Plans are P_{28} and P_{34}, with hay and corn selling activities included and excluded respectively. Results from these budget Plans are compared to the actual Plans (Table 6.25).

Table 6.25. Comparison of Actual Return Pre- and Post-Loan with Budgeted Returns Pre- and Post-Loan

	Capital Level	Return*	Residual** Return
	$	$	$
Actual Pre-Loan	5751	3272	872
Actual Post-Loan	7100	7982	5582
Budgeted			
Pre-Loan P_{16}	6000	7454	5054
Pre-Loan P_{22}	6000	5372	2972
Post-Loan P_{28}	6000	7871	5471
Post-Loan P_{34}	6000	5187	2787

*This is the return plus or minus inventory change, less a depreciation charge.

**Return less a $2,400 living expense.

If, as in the pre- and post-loan budget Plans, the $15,600 necessary to purchase the new land is added to the operating capital the difference in return is quite marked (Table 6.26).

Table 6.26. Extra Return in Budget Plans over Actual if $15,600 added to operating capital rather than fixed capital.
Hay and Corn selling activities included in P_{16} and excluded in P_{22}.

1	2	3	4	5
Plan No.	Operating Capital*	Budgeted Return if $15,600 added to Op. Capital	Actual Return if $15,600 added to Fixed Capital	Extra Return if Additional Capital Added to Op. Capital
	$	$	$	$
16	7100	14410	7982	6428
22	7100	12995	7982	5013

*The actual amount of post-loan operating capital was $7,100, this is quite close to the lowest amount of $6,000, used in the budget Plans.

Column 2 shows the actual amount of operating capital used by the farm operator in 1960, the year he received the loan. He purchased the 192 acres of new land with the $15,600 and the actual return is shown in column 4. If he could have added the $15,600 of borrowed capital to his own operating capital the budgeted return is indicated in column 3. Column 5 indicates the extra return when the borrowed capital is added to operating capital rather than being invested in the fixed land resource.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

Government Agricultural Credit Agencies are confronted with some very serious problems. They are in the business of lending or investing public money in farm firms and must, therefore, be very concerned with the security of this capital. However, this concern for the safety of the loans should not be the only concern. The efficient allocation of resources and the optimum combination of enterprises are of utmost importance if the farmer and society are to receive the greatest benefit from the additional agricultural capital.

The present credit Acts usually state that the farmer must provide sufficient collateral mainly in the form of land. This limits the effectiveness and efficiency of the Acts. There is no guarantee that the use of additional capital to purchase extra land will return the farm operator more than if invested in some other part of the farm business. Farm renters are excluded from the benefits of most of the Acts. This means that many farmers who may be excellent managers and very efficient in their operations are unable to take advantage of the present credit policies if they choose to rent their land.

With the main emphasis on collateral in the form of

land the tendency is for farmers to purchase additional acres rather than some other resource. This is the case with the particular farm analysed in this study where the main portion of the loan received was used for the purchase of additional land.

The record analysis used in this study indicates size of business, the return on investment in the various enterprises and the return to labour for a particular farm. Also indicated are the efficiency of labour, crops and livestock as well as the debt carrying capacity of the farm business as it existed prior to the receipt of a loan from the Manitoba Agricultural Credit Corporation.

The farmer in this study purchased additional land but the record analysis indicated that there was hardly enough labour available to properly farm the land that was already owned. This means that the farmer should have invested part of the borrowed capital in some other part of the farm business or possibly in some larger machinery. The record analysis also indicated that for this particular farm, the return on investment in the cattle enterprise was very low considering the large amount of capital invested. The return per dollar invested in the cattle is low because the cattle on the farm are quite high value animals but are not realizing returns in the proper relation to their value.

The record analysis of a farm business can point up

the strengths and weaknesses in the farm business and thus help the farm operator allocate his limited resources. Record analysis is limited, however, to a picture of how the farm business stands at one point in time. It does not and cannot indicate the results if the present farm enterprise combination was changed or new enterprises added to the existing unit. To obtain this type of information some type of a budget analysis is necessary.

A budget is a detailed production plan for a firm for some future period. With the use of the linear programming technique, as was used in this study, all possible enterprise combinations that are being investigated are considered simultaneously, thus the plan returning the maximum profit is the one selected.

The results of this study indicate that capital allocation by the use of productivity or budget analysis resulted in a much higher marginal productivity of capital than that obtained when resources are allocated according to the traditional equity collateral analysis.

The low return per dollar invested in the present livestock enterprise on the subject farm was indicated by the record analysis. Without a record analysis low returns in this part of the farm business would have been very difficult to discover. It is necessary, however, to have some type

of a budget analysis if either the farmer or the credit agency are to know what changes are necessary to maximize returns. The budget or linear programming analysis confirmed the weakness in the cattle enterprise and indicated the changes necessary to increase returns from this particular operation. The high valued cattle should be replaced with good quality lower valued stock and the returns can then be brought into the proper relationship with the capital invested. Stocker calves and hogs also enter the budget plans as operating capital increases.

The linear programming analysis indicated that intensification of the farm unit by allocating capital into variable resources rather than the fixed land resource, greatly increased the farmer's net return.

The results show that for the crop rotations considered in the study, those that include fertilizer enter the plans most frequently. This indicates that with the given yields and prices, fertilizer competed very favourably with other resource inputs for the use of the limited operating capital.

The efficient allocation of resources and the optimum combination of enterprises are two of the most important decisions facing farmers. They should also be the concern of those who decide and administer Government credit policy if efficient use is to be made of this additional farm capital.

In this study, record and budget or linear programming analysis have been used to show how the marginal productivity of capital can be increased from that obtained when credit is invested according to the traditional equity collateral method.

The validity of any linear programming analysis is dependent on the reliability of the, input-output coefficients. Closer co-operation is necessary between the agricultural economist, federal and provincial departments of agriculture and credit agencies. The reliability and speed with which linear programming or the budget technique can be applied in the credit field in future will depend on this co-operation. Some type of agency or authority should be set up to collect all relevant data into one central place where it is readily available to all who need such information. This information must be in a form easily interpreted and under constant revision.

The linear programming analysis of this thesis has provided a preliminary evaluation of the ability of variable resource inputs to compete with fixed resource inputs. Future studies of a similar nature should refine and expand specific procedures for analysing the marginal productivity of the fixed land input.

Credit agencies should not only be concerned with

capital allocation within the farm firm but also between farms. Further research should be directed to this end if society as a whole is to receive the greatest benefit from additional agricultural credit.

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Table I.1

Size and Financial Comparison 1957

	Farm A	Comparison Farms 1	2	3	4	5 (rented)	Av. for soil Group II 18 Farms
Acres: Improved	580	640	392	874	626	465	564
Total	640	800	532	950	640	480	624
P.M.W.U.: Crops	250	228	209	345	170	254	233
Livestock	188	179	212	145	161	135	144
Total P.M.W.U.	438	419	423	490	331	392	377
Total Receipts	$ 8934	5653	9580	12171	9963	5293	9352
Farm Income	$ 6325	692	4164	4922	-1714	2546	3518
Op. Labour Earnings	$ 5080	182	1954	3418	-5762	2639	2258
Real Estate	$ 30000	20750	16000	35000	64000	28800*	26183
Cattle	$ 12020	3125	3665	3410	3895	4005	(3600)
Other Livestock	$ -	1223	905	776	1460	285	
Mach. & Equipment	$ 10776	10250	13022	10250	26301	10229	12277
Total Farm Capital	$ 59588	39438	43284	60006	103824	(22754) 51554	46920
Liabilities: Long	$ 10700	2000	-	4515	-	-	(8622)
Int.	$ 1108	7011	984	2165	-	10600	
Short	$ 2604	1847	-	700	3819	1103	
Total	$ 14412	10858	984	7380	3819	11703	
Net Worth	$ 50982	32579	50612	55529	112319	16443	44814
Asset-Liability Ratio	4.1	5.37	86.2	9.97	21.42	1.94	5.44
Op. Equity in Bus.	% 76	72	98	88	96	49	81
Rate Capital Turnover	7.0	6.3	6.15	6.51	10.6	3.99	5.6

* not owned

Bracketed number indicates operator's equity

Table I.2

Yields, Value of Production, Work Units 1957

	Farm A				Comparison Farms 1				2				3				4				5			
	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax
Crops																								
Yield/Acre	18	29	9	4	20	5	10	3.9	30	33	17	3	22	29	14	2.2	21	40	-	2	20	37	-	4.1
Value of Prod.	$2990	2025	180	972	2958	137	559	1080	2220	1342	900	283	5773	1220	315	945	2960	1952	-	540	3996	2745	-	1215
Work Units	56	58	11	45	50	22	31	51	25	30	30	17	82	35	12	95	47	40	-	50	66	60	-	55
Value of Prod. /Work Units	54	35	16	22	59	6	18	21	89	45	30	17	70	35	26	10	63	49	-	11	61	46	-	22

	H	C.E.	H	C.E.	Millet	H	C.E.	H	C.E.	H	C.E.	H	C.E.
Yield/Acre	-	6.3	3	-	1.57	.7	4.3	.8	3	1	-	.4	4.6
Value of Prod.	-	1250	1320	-	450	440	750	111	180	550	-	440	300
Work Units	29	52	26	-	10	36	45	8	22	32	-	58	14
Value of Prod. /Work Units	0	24	51	-	45	12	17	14	8	17	-	8	21

	Farm A			Comparison Farms 1			2			3			4			5		
	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry
Livestock																		
Value of Prod.	$6194	-	92	1653	971	493	1978	1126	-	2102	531	-	1608	1358	-	1911	80	-
Work Units	167	-	20	111	17	50	176	16	-	121	8	-	107	37	-	134	1	-
Investment	$9630	-	154	2570	590	261	3907	417	-	3440	310	-	3947	1131	-	3675	30	-
Value of Prod. /$100 Invest.	64	-	60	64	165	189	51	270	-	61	171	-	41	120	-	52	267	-
No.Animal Units	45.7	-	1.1	20.2	4.8	2.5	35.7	2.4	-	27	2.3	-	23	7.3	-	252	.4	-
Value of Prod. /Animal Units	135	-	83	82	202	197	55	469	-	78	231	-	70	186	-	76	200	-
Value of Prod. /Work Units	37	-	-	15	57	-	11	70	-	17	66	-	15	38	-	14	80	-

H = Hay C.E. = Corn Ensilage Investment = Average value for the year

Table I.3

Volume and Efficiency Comparisons 1957

	Farm A	Comparison Farms 1	2	3	4	5 (rented)	Av. for Soil Group II 18 Farms
Crops							
Value Crop Prod.	$ 7416.00	7343.00	6762.00	13012.00	6552.00	8696.00	8979.00
P.M.W.U. in Crops	250.00	228.00	209.00	345.00	170.00	254.00	233.00
Value Crops/Imp.acre	12.79	11.47	17.25	14.64	10.47	18.70	15.92
Power & Mach.cost/imp.acre	5.13	4.70	9.38	3.57	6.76	7.36	5.55
Mach. Inv./imp. acre	16.88	14.19	31.87	10.42	42.44	22.09	18.22
Livestock							
Value Livestock Prod.	6287.00	3117.00	3623.00	2765.00	3310.00	1992.00	3389.00
P.M.W.U. in Livestock	188.00	179.00	212.00	145.00	161.00	135.00	144.00
Value Livestock/$100 Inv.	63.60	91.24	76.01	70.78	63.50	50.30	94.14
Total Work (months)	16.8	16.1	16.3	18.8	12.7	15.1	14.6
Man months of labour	12.9	21.8	23.0	24.9	33.9	24.0	18.5
Crop work/Man Mth. (days)	19.3	5.8	9.0	13.8	5.0	10.5	12.6
Lvstk. " " " "	14.6	8.2	9.0	5.8	4.7	5.6	7.8
Total " " " "	33.9	14.0	18.0	19.6	9.7	16.1	20.4

Table I.4

Size and Financial Comparison 1958

	Farm A	Comparison Farms 1	2	3	4	5 (rented)	Av. for soil Group II
Acres: Improved	820	640	586	889	626	465	536
Total	880	800	777	950	640	480	610
P.M.W.U.: Crops	352	275	265	407	267	258	225
Livestock	214	235	218	214	260	155	150
Total P.M.W.U.	571	510	491	621	527	413	378
Total Receipts	$ 13679	10716	9436	17378	13567	8712	10862
Farm "	$ 9698	8504	6360	12062	3233	-1842	5481
Op. Labour Earnings	$ 8088	7742	2929	9896	795	-1920	4193
Real Estate	$ 30000	20750	31100	35000	44000	28800*	24802
Cattle	$ 13920	5750	4000	5690	4660	4645	(4880)
Other Livestock	$ -	2350	895	934	1650	1951	
Mach. & Equipment	$ 14639	10632	12492	17634	24661	12759	11587
Total Farm Capital	$ 68615	46437	60060	73792	81999	(24173) 52973	49297
Liabilities: Long	$ 9700	6000	10500	7887	15000	-	(10030)
Int.	$ 4083	2260	-	1125	-	10800	
Short	$ 2553	1364	1473	-	-	2629	
Total	$ 16336	9624	11973	9012	15000	13429	
Net Worth	$ 59023	40347	57590	70546	94395	16589	48917
Asset-Liability Ratio	4.2	4.8	5.02	8.19	4.06	1.83	4.91
Op. Equity in Bus.	% 76	79	80	88	75	45	80
Rate Capital Turnover	6.1	4.6	5.4	4.6	7.2	2.9	4.6

* not owned

Bracketed number indicates operator's equity

Table I.5

Yields, Value of Production, Work Units 1958

	Farm A				Comparison Farms 1				2				3				4				5			
	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax	W	O	B	Flax
Crops																								
Yield/Acre	22	34	40	8	20	40	20	7	30	32	31	6.5	28	39	30	12	17	27	37	4.3	14	37	-	5.4
Value of Prod.	$7030	3243	640	2008	4736	1410	480	1197	4440	1269	2800	185	8693	2115	840	3352	3034	940	1360	1710	3700	705	-	1243
Work Units	109	100	10	30	80	37	15	30	50	42	55	5	106	57	17	49	58	37	26	69	86	20	-	40
Value of Prod. /Work Units	$ 64	32	64	67	59	38	32	40	88	30	51	37	82	37	49	68	52	25	52	25	43	35	-	31
		H	C.E.			H	C.E.		H	C.E.	S.C.S.		H	C.E.	SunF.		H	C.E.	W.E.		H	C.E.	W.E.	
Yield/Acre		.9	7.1			.9	8		.5	4.6	4		.7	1.2	553 lbs.		.2	-	.8		1.1	2.2	2.5	
Value of Prod.		660	1250			895	100		275	600	800		500	250	1260		110	-	250		132	1125	500	
Work Units		42	45			54	32		34	34	26		45	52	39		32	-	43		7	75	26	
Value of Prod. /Work Units		16	28			17	3		8	18	31		11	5	32		4	-	6		19	15	19	

	Farm A			Comparison Farms 1			2			3			4			5		
	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry	Cattle	Hogs	Poultry
Livestock																		
Value of Prod.	$7982	-	254	3407	2888	678	4031	844	311	4451	1571	157	2935	3995	283	2158	1398	-
Work Units	192	-	22	146	46	46	169	28	20	135	73	6	163	77	20	139	16	-
Investment	12970	-	76	4687	1550	225	3832	462	87	4482	741	103	4277	1240	112	4215	863	-
Value of Prod. /$100 Invest.	$62	-	334	73	186	301	105	183	357	99	212	152	68	322	253	51	162	-
No.Animal Units	49.7	-	2.6	26	15.6	2.2	30.9	6.5	1.0	28.5	13.2	.8	24	26	1	28.7	3.8	-
Value of Prod. /Animal Units	160	-	98	131	185	308	130	129	311	156	119	197	121	157	284	75	368	-
Value of Prod. /Work Units	42	-	-	23	63	-	24	30	-	33	22	-	18	52	-	16	87	-

H = Hay C.E. = Corn Ensilage S.C.S. = Sweet Clover Silage W.E. = Wheat Ensilage Investment = Average value for the year

Table I.6

Volume and Efficiency Comparisons 1958

	Farm A	Comparison Farms 1	2	3	4	5 (rented)	Av. for soil Group II 19 Farms
Crops							
Value Crop Prod.	$14191.00	10618.00	10819.00	19240.00	7404.00	7392.00	10219.00
P.M.W.U. in Crops	352.00	275.00	265.00	407.00	267.00	258.00	225.00
Value Crops/Imp. acre	17.30	16.59	18.46	21.64	11.83	15.90	19.07
Power & Mach.cost/imp.acre	4.44	4.67	6.24	4.75	6.80	10.27	5.98
Mach.Inv./imp.acre	15.50	16.32	21.49	17.96	40.70	26.79	21.49
Livestock							
Value Livestock Prod.	8237.00	6973.00	5186.00	6179.00	7214.00	3557.00	4362.00
P.M.W.U. in Livestock	214.00	235.00	218.00	214.00	260.00	155.00	150.00
Value Livestock/$100 Inv.	62.40	107.91	109.60	115.80	124.22	66.90	100.17
Total Work (months)	22.0	19.6	18.9	23.9	20.3	15.9	14.6
Man Months of Labour	17.4	18.0	26.4	26.4	25.2	24.0	18.4
Crop Work/Man Mth.(days)	20.2	15.2	10.0	15.4	10.5	10.7	12.2
Lvstk. " " " "	12.2	13.0	8.2	8.1	10.3	6.4	8.1
Total " " " "	32.4	28.2	18.2	23.5	20.8	17.1	20.3

APPENDIX II

Table II.1. Alternative Rotations Considered in Linear Programming Analysis.

	Expected Yield (per Acre)		Fertilizer Use	
	Unfertilized	Fertilized at Recommended Rate	Kind	Amount lbs/Acre
No. 1 5 Years Home Land				
Corn	8.0	12.0	23-23-0	150
Oats	30.0	40.0	"	80
Oats seeded	25.0	35.0	"	80
Hay	1.0	2.0	11-48-0	100
Hay and Break	0.8	1.5	Nil	
No. 2 4 Years Home Land				
Corn	8.0	12.0	23-23-0	150
Oats seeded	30.0	40.0	"	80
Hay	1.0	2.0	11-48-0	100
Hay and Break	0.8	1.5	Nil	
No. 3 5 Years Home Land				
Corn	8.0	12.0	23-23-0	150
Oats seeded	30.0	40.0	"	80
Hay	1.0	2.0	11-48-0	100
Hay	1.0	2.0	"	100
Hay and Break	0.8	1.5	Nil	
No. 4 4 Years Home Land				
Hay	1.0	2.0	11-48-0	100
Hay	1.0	2.0	"	100
Hay and Break	0.8	1.5	Nil	
Oats seeded	30.0	40.0	23-23-0	80

	Expected Yield (per Acre)		Fertilizer Use	
	Unfertilized	Fertilized at Recommended Rate	Kind	Amount lbs/Acre
No. 5 4 Year Far Land				
Wheat	25.0	30.0	11-48-0	40
Flax	10.0	11.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80
Clover--Fallow	-	-	-	-
No. 6 6 Year Far Land				
Wheat	25.0	30.0	11-48-0	40
Flax	10.0	12.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80
Hay	1.5	2.5	11-48-0	100
Fallow	-	-	-	-
No. 7 10 Year Far Land				
Wheat	25.0	30.0	11-48-0	40
Wheat	18.0	25.0	23-23-0	80
Oats seeded	25.0	35.0	"	80
Clover--Fallow	-	-	-	-
Wheat	25.0	30.0	11-48-0	40
Flax	10.0	12.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80
Hay 8	1.5	2.5	11-48-0	100
Hay	1.5	2.5	"	100
Hay and Break	1.0	1.5	Nil	
No. 8 6 Year Far Land				
Wheat	25.0	30.0	11-48-0	40
Flax	10.0	12.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80
Hay	1.5	2.5	11-48-0	100
Hay	1.5	2.5	"	100
Hay and Break	1.0	1.5	Nil	

	Expected Yield (per Acre)		Fertilizer Use	
	Unfertilized	Fertilized at Recommended Rate	Kind	Amount lbs/Acre
No. 9 6 Year New Land				
Peas	18.0	18.0	Nil	
Oats seeded	28.0	37.0	23-23-0	80
Clover---Fallow	-	-	-	-
Wheat	25.0	30.0	11-48-0	40
Oats	22.0	34.0	23-23-0	80
Fallow	-	-	-	-
No. 10 4 Year New Land				
Peas	18.0	18.0	Nil	
Wheat	20.0	27.0	23-23-0	80
Oats seeded	20.0	32.0	"	80
Clover---Fallow	-	-	-	-
No. 11 8 Year New Land				
Fallow	-	-	-	-
Peas	18.0	18.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80
Hay	1.5	2.5	11-48-0	100
Hay	1.5	2.5	"	100
Hay and Break	1.0	1.5	Nil	
Wheat	25.0	30.0	11-48-0	40
Oats	25.0	35.0	23-23-0	80
No. 12 6 Year New Land				
Hay	1.5	2.5	11-48-0	100
Hay	1.5	2.5	"	100
Hay	1.5	2.5	"	75
Fallow	-	-	-	-
Peas	18.0	18.0	Nil	
Oats seeded	25.0	35.0	23-23-0	80

Note: Yields are presented on the basis of bushels per acre for grain crops and tons per acre for forage crops (hay) and corn ensilage.

Table II.2. Input-Output Coefficients for Pre-Loan Linear Programming, No Interest.

Resource		Net Prices / Resource Supply Level	-7.572 R_1	-12.904 R_1F	-7.444 R_2	-13.042 R_2F	-6.870 R_3	-12.838 R_3F
Spring Labor	Hours	1,272.	0.722	0.722	0.547	0.547	0.447	0.447
Summer Labor	Hours	768.	1.405	1.858	1.732	2.299	1.859	2.579
Fall Labor	Hours	1,248.	1.257	1.745	1.368	1.978	1.104	1.625
Winter Labor	Hours	1,576.	0.235	0.235	0.202	0.202	0.191	0.191
Bldg. Space A	Sq. Ft.	1,294.	-	-	-	-	-	-
Bldg. Space B	Sq. Ft.	806.	-	-	-	-	-	-
Land Home	Acres	153.	1.000	1.000	1.000	1.000	1.000	1.000
Land Far	Acres	620.	-	-	-	-	-	-
Pasture	Acres	157.	-	-	-	-	-	-
Capital	Dollars	6,000.	7.572	12.904	7.444	13.042	6.870	12.838
Corn	Tons	0	-1.600	-2.400	-2.000	-3.000	-1.600	-2.400
Hay	Cwt.	0	-7.200	-14.000	-9.000	-17.500	-11.200	-22.000
Oats	Bus.	0	-10.550	-14.550	-7.312	-9.812	-5.850	-7.850
Wheat	Bus.	0	-	-	-	-	-	-
Flax	Bus.	0	-	-	-	-	-	-
Barley	Bus.	0	-	-	-	-	-	-

-6.495	-11.558	-7.008	-8.840	-7.224	-10.644	-7.293	-10.756	-6.493
R_4	R_4F	R_5	R_5F	R_6	R_6F	R_7	R_7F	R_8
0.407	0.407	0.818	0.818	0.561	0.561	0.548	0.548	0.435
1.941	2.880	0.167	0.167	1.224	1.712	1.133	1.500	1.778
0.235	0.320	0.799	0.799	0.549	0.606	0.648	0.682	0.572
0.202	0.202	0.313	0.313	0.258	0.258	0.280	0.280	0.258
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1.000	1.000	-	-	-	-	-	-	-
-	-	1.000	1.000	1.000	1.000	1.000	1.000	1.000
-	-	-	-	-	-	-	-	-
6.495	11.558	7.008	8.840	7.224	10.644	7.293	10.756	6.493
-	-	-	-	-	-	-	-	-
-14.000	-27.500	-	-	-10.000	-16.680	-8.000	-13.000	-13.200
-7.312	-9.812	-6.062	-8.562	-4.042	-5.679	-4.850	-6.850	-4.042
-	-	-6.016	-7.266	-4.101	-4.844	-4.112	-5.312	-4.010
-	-	-2.383	-2.633	-1.708	-1.922	-0.953	-1.153	-1.708
-	-	-	-	-	-	-	-	-

-10.156	5.607	14.716	11.008	13.003	13.003	13.003	13.003
R_8^F	Hogs Wean-lings	Hogs Feed & Farrow	Hogs Feeder Winter	Beef Cow-Calf Hay	Add. Cow-Calf Hay	Beef Cow-Calf Corn	Add. Cow-Calf Corn
	(hog)	cwt. (dressed)	cwt. (d)	cwt. (live)	cwt. (live)	cwt. (live)	cwt. (live)
0.435	0.222	0.360	-	0.294	0.294	0.294	0.294
2.389	0.166	0.270	-	0.084	0.084	0.084	0.084
0.770	0.222	0.360	-	0.252	0.252	0.252	0.252
0.258	0.722	1.170	1.251	3.568	3.568	3.568	3.568
-	2.880	3.833	4.169	9.877	-	9.877	-
-	-	-	-	-	9.877	-	9.877
-	-	-	-	-	-	-	-
1.000	-	-	-	-	-	-	-
-	-	-	-	0.741	0.741	0.741	0.741
10.156	3.393	7.423	11.133	6.534	6.534	6.534	6.534
-	-	-	-	-	-	1.046	1.046
-21.680	-	-	-	10.272	10.272	4.578	4.578
-5.679	2.847	4.855	2.891	0.237	0.237	0.237	0.237
-4.844	0.029	0.313	0.312	-	-	-	-
-1.922	-	-	-	-	-	-	-
-	2.042	5.575	4.213	0.168	0.168	0.168	0.168

12.513	12.513	7.512	7.512	5.000	0.740	0.540	1.400	3.000	2.000
Stockers Hay cwt. (L)	Stockers Corn cwt. (L)	Feeders Hay Winter cwt. (L)	Feeders Corn Winter cwt. (L)	Sell Corn Ton	Sell Hay cwt.	Sell Oats bu.	Sell Wheat bu.	Sell Flax bu.	Sell Peas bu.
0.249	0.249	-	-	-	-	-	-	-	-
0.188	0.188	-	-	-	-	-	-	-	-
0.062	0.062	-	-	-	-	-	-	-	-
0.747	0.747	0.624	0.624	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
9.237	9.237	14.205	14.205	0	0	0	0	0	0
-	0.136	-	0.078	1.	-	-	-	-	-
2.155	1.293	1.562	1.094	-	1.	-	-	-	-
6.761	6.761	4.596	4.596	-	-	1.	-	-	-
-	-	-	-	-	-	-	1.	-	-
-	-	-	-	-	-	-	-	1.	-
2.544	2.095	1.953	1.628	-	-	-	-	-	-

-0.550	-0.870	-0.750
Buy Oats	Buy Barley	Buy Hay
bu.	bu.	cwt.
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
.55	.87	.75
-	-	-
-	-	-1.
-	-	-
-	-	-
-	-	-
-	-	-

Table II.3. Input-Output Coefficients for Post-Loan Linear Programming, Interest Included.

Resource		Net Prices	-8.026	-13.678	-7.891	-13.824	-7.282	-13.608
		Resource Supply Level	R_1	R_1F	R_2	R_2F	R_3	R_3F
Spring Labor	Hours	1,272.	0.722	0.722	0.547	0.547	0.447	0.447
Summer Labor	Hours	968.	1.405	1.858	1.732	2.299	1.859	2.579
Fall Labor	Hours	1,248.	1.257	1.745	1.368	1.978	1.104	1.625
Winter Labor	Hours	1,596.	0.235	0.235	0.202	0.202	0.191	0.191
Bldg. Space A	Sq. Ft.	1,294.	-	-	-	-	-	-
Bldg. Space B	Sq. Ft.	806.	-	-	-	-	-	-
Land Home	Acres	153.	1.000	1.000	1.000	1.000	1.000	1.000
Land Far	Acres	620.	-	-	-	-	-	-
Land New	Acres	192.	-	-	-	-	-	-
Pasture	Acres	157.	-	-	-	-	-	-
Capital	Dollars	0	8.026	13.678	7.891	13.824	7.282	13.608
Corn	Tons	0	-1.600	-2.400	-2.000	-3.000	-1.600	-2.400
Hay	Cwt.	0	-7.200	-14.000	-9.000	-17.500	-11.200	-22.000
Oats	Bus.	0	-10.550	-14.550	-7.312	-9.812	-5.850	-7.850
Wheat	Bus.	0	-	-	-	-	-	-
Flax	Bus.	0	-	-	-	-	-	-
Peas	Bus.	0	-	-	-	-	-	-
Barley	Bus.	0	-	-	-	-	-	-

-6.885	-12.251	-7.428	-9.370	-6.883	-10.765	-12.269	-14.312	-13.242
R_4	R_4F	R_5	R_5F	R_8	R_8F	R_9	R_9F	R_{10}
0.407	0.407	0.818	0.818	0.435	0.435	0.545	0.545	0.588
1.941	2.880	0.167	0.167	1.778	2.389	0.216	0.216	0.151
0.235	0.32	0.799	0.799	0.572	0.770	0.682	0.682	0.704
0.202	0.202	0.313	0.313	0.258	0.258	0.295	0.295	0.313
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1.000	1.000	-	-	-	-	-	-	-
-	-	1.000	1.000	1.000	1.000	-	-	-
-	-	-	-	-	-	1.000	1.000	1.000
-	-	-	-	-	-	-	-	-
6.885	12.251	7.428	9.370	6.883	10.765	12.269	14.312	13.242
-	-	-	-	-	-	-	-	-
-1.400	-27.500	-	-	-13.200	-21.680	-	-	-
-7.312	-9.812	-3.031	-4.281	-2.021	-2.839	-3.979	-5.729	-2.406
-	-	-6.016	-7.266	-4.010	-4.849	-4.010	-4.844	-4.766
-	-	-2.383	-2.633	-1.708	-1.922	-	-	-
-	-	-	-	-	-	-3.000	-3.000	-4.500
-	-	-	-	-	-	-	-	-

-15.631	-12.546	-17.202	-12.415	-16.855	5.050	13.948	10.375	9.575
$R_{10}F$	R_{11}	$R_{11}F$	R_{12}	$R_{12}F$	Hogs Wean-lings	Hogs Feed & Farrow	Hogs Feeder Winter	Beef Cow-Calf Hay
					Hog	cwt. (dressed)	cwt. (d)	cwt. (d)
0.588	0.334	0.334	0.316	0.316	0.222	0.360	-	0.294
0.151	1.292	1.715	1.735	2.268	0.166	0.270	-	0.084
0.704	0.488	0.509	0.286	0.372	0.222	0.360	-	0.252
0.313	0.258	0.258	0.220	0.220	0.722	1.170	1.251	3.568
-	-	-	-	-	2.880	3.833	4.167	9.877
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
1.000	1.000	1.000	1.000	1.000	-	-	-	-
-	-	-	-	-	-	-	-	0.741
15.631	12.546	17.202	12.415	16.855	3.950	8.192	11.763	9.963
-	-	-	-	-	-	-	-	-
-	-10.020	-16.240	-15.000	-25.020	-	-	-	10.272
-7.812	-5.969	-8.469	-4.042	-5.708	2.847	4.855	2.891	0.237
-6.516	-3.008	-3.633	-	-	-	0.313	0.312	-
-	-	-	-	-	-	-	-	-
-4.500	-2.250	-2.250	-3.000	-3.000	-	-	-	-
-	-	-	-	-	2.042	5.575	4.213	0.168

9.575	9.575	9.575	11.959	11.959	7.090	7.090	5.000	0.740
Add. Cow-Calf Hay cwt. (d)	Add. Cow-Calf Corn cwt. (d)	Add. Cow-Calf Corn cwt. (d)	Stockers Hay cwt. (d)	Stockers Corn cwt. (d)	Feeders Hay cwt. (d)	Feeders Corn cwt. (d)	Sell Corn Ton	Sell Hay cwt.
0.294	0.294	0.294	0.249	0.249	-	-	-	-
0.084	0.084	0.084	0.188	0.188	-	-	-	-
0.252	0.252	0.252	0.062	0.062	-	-	-	-
3.568	3.568	3.568	0.747	0.747	0.624	0.624	-	-
-	9.877	-	-	-	-	-	-	-
9.877	-	9.877	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
0.741	0.741	0.741	-	-	-	-	-	-
9.963	9.963	9.963	9.791	9.791	14.660	14.660	0	0
-	1.046	1.046	-	0.136	-	0.078	1.	-
10.272	4.578	4.578	2.155	1.293	1.562	1.094	-	1.
0.237	0.237	0.237	6.761	6.761	4.596	4.596	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
0.168	0.168	0.168	2.544	2.095	1.953	1.628	-	-

0.540	1.400	3.000	2.000	-0.550	-0.870	-0.750
Sell Oats	Sell Wheat	Sell Flax	Sell Peas	Buy Oats	Buy Barley	Buy Hay
bus.	bus.	bus.	bus.	bus.	bus.	cwt.
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	0	0	0	0.550	0.870	1.500
-	-	-	-	-	-	-
-	-	-	-	-	-	-1.
1.	-	-	-	-1.	-	-
-	1.	-	-	-	-	-
-	-	1.	-	-	-	-
-	-	-	1.	-	-	-
-	-	-	-	-	-1.	-

APPENDIX III

GLOSSARY

Animal Unit (A.U.) - A mature cow or the equivalent in other livestock from the standpoint of feed consumed and manure produced on the farm for a full year.

Productive Man Work Unit (P.M.W.U.) or W.U. - represents a 10 hour man-work-day.

Traditional credit appraisal - any method of credit analysis that places the main emphasis on availability of ample security or collateral to cover the loan.

Farm A - the farm on which this study was carried out has been called Farm A for the sake of clarity.

Farm Income - Receipts minus expenses plus or minus inventory change.

Operators Labour Earnings - Farm Income plus farm perquisites minus an interest on average capital at 5 per cent.

Man Month of Labour - one man available for one month.

Total Work (Months) - Work units divided by number of 10 hour days work per month. Number of 10 hour days work per month is 26.

Crop Work/Man Month (Days) - Number of work units in crops divided by number of man months of labour.

Pre-Loan Farm - Consisted of 153 arable acres of Almassippi Sand, 157 acres pasture and 620 arable acres of Red River and Osborne Clay. 240 acres of the Red River and Osborne Clay were rented.

Post-Loan Farm - Same as above with the addition of 192 arable acres of Red River Clay.

Home land - the 153 acres of Almassippi Sand.

Far land - the 620 acres of Red River and Osborne Clay.

New land - the 192 acres of Red River Clay.

Residual Return - is the return to the farm operator for labour, management and capital.